Municipal and County Engineering

DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF ALL PUBLIC WORKS

Vol. LV. SEPTEMBER, 1918. No. 3.

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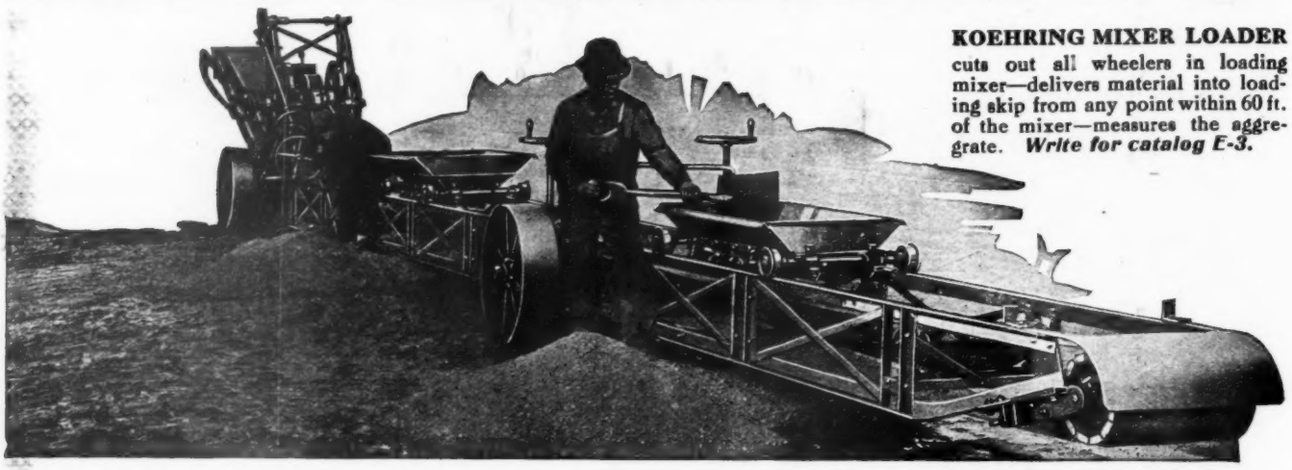

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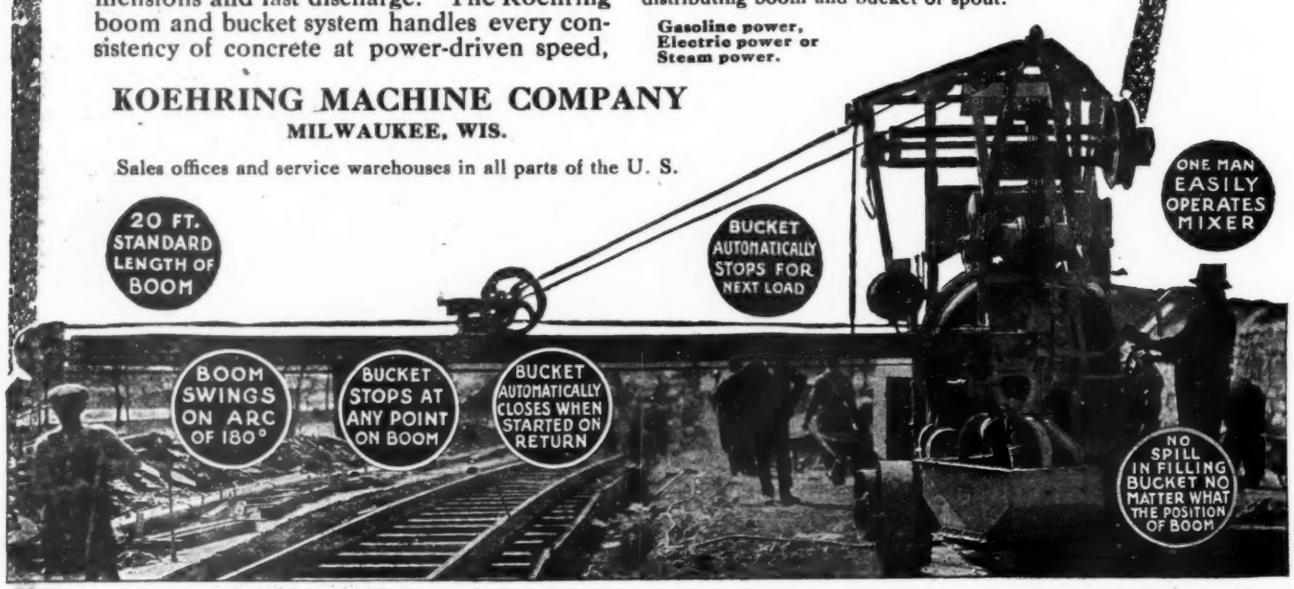
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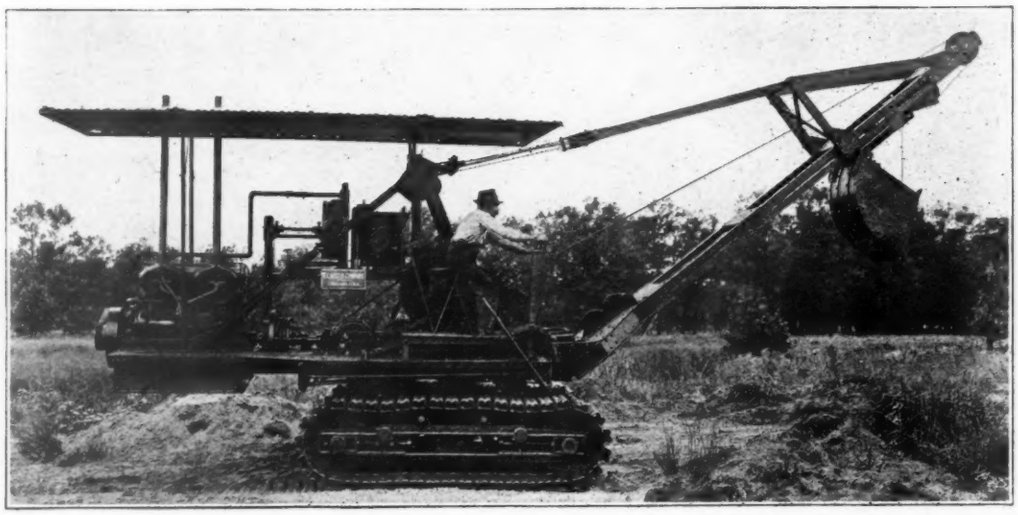

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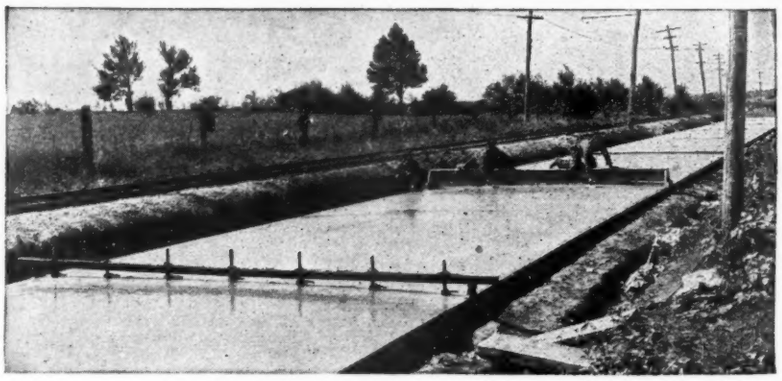

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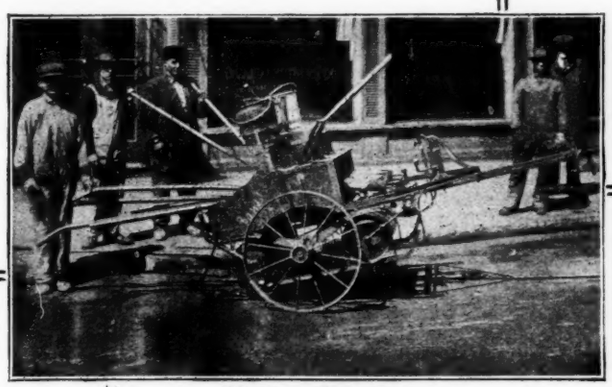

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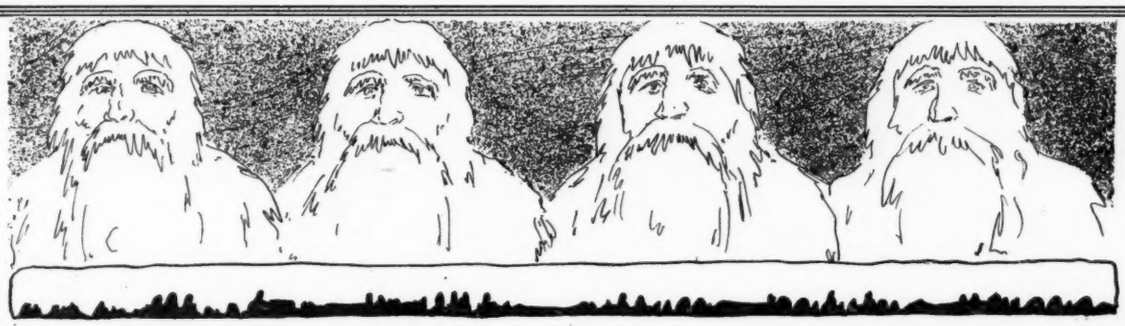

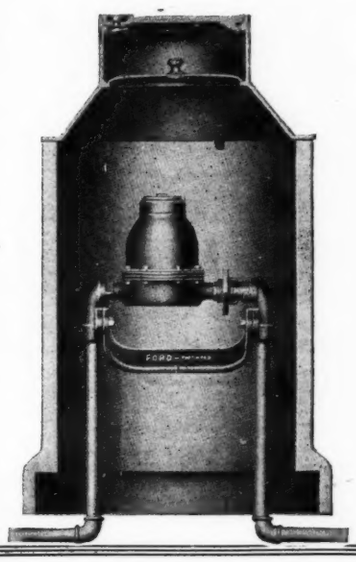

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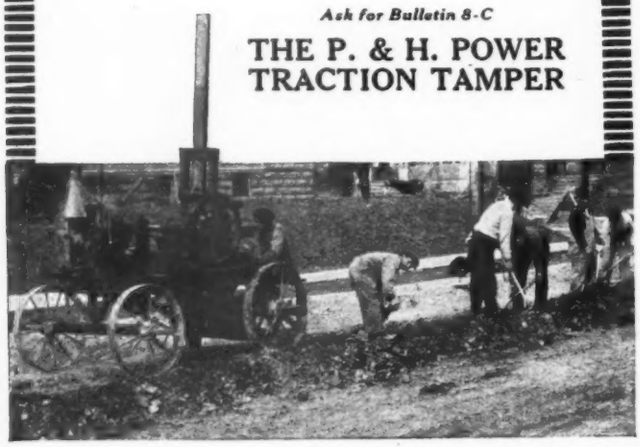

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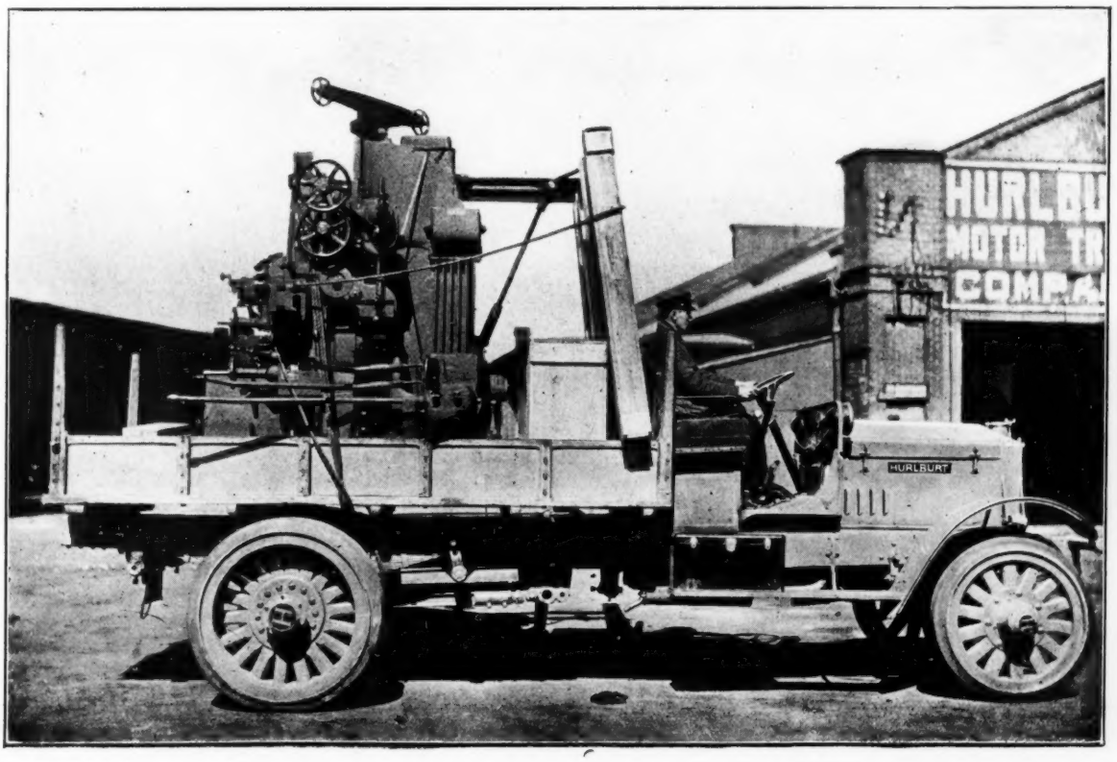

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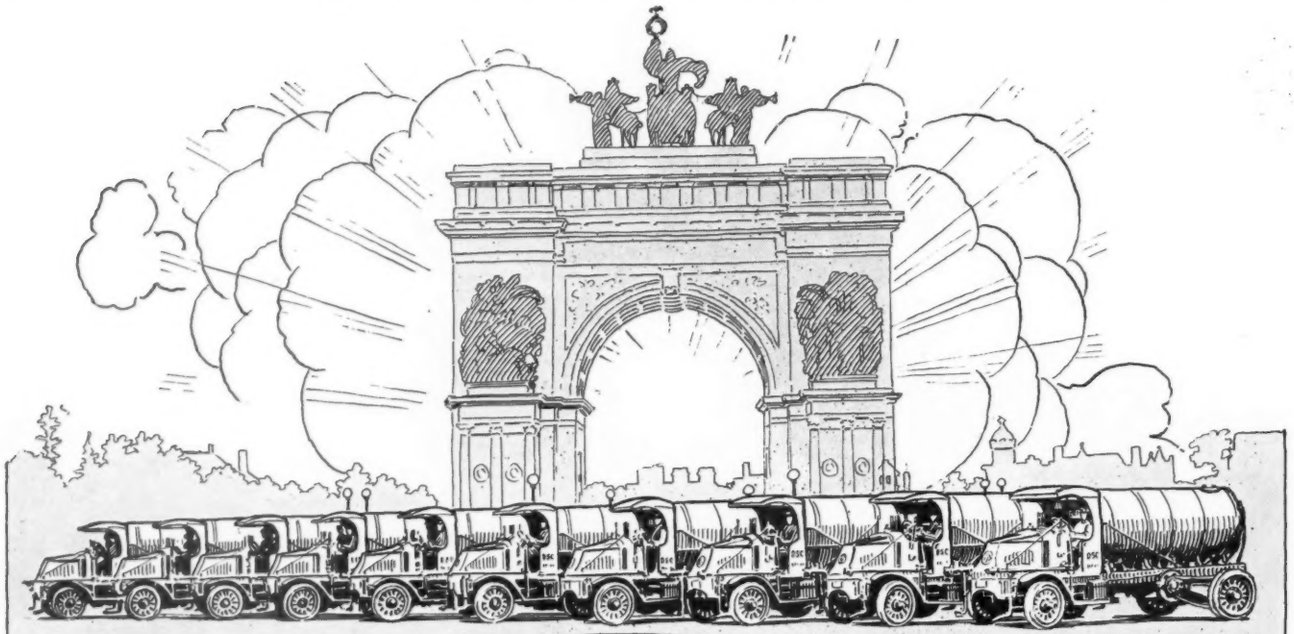

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In America's greatest city, only the most efficient methods and means find a place.

New York's Street Cleaning Department is using MACK Sprinklers, Flushers and Dump Trucks to efficiently clean hundreds of miles of city streets.

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Equipped with every improvement and convenience to facilitate the work and eliminate hand labor, MACK Trucks get street cleaning costs down to bedrock.

From 1 to 7½ tons—trailers to 15 tons. Special bodies for every need.

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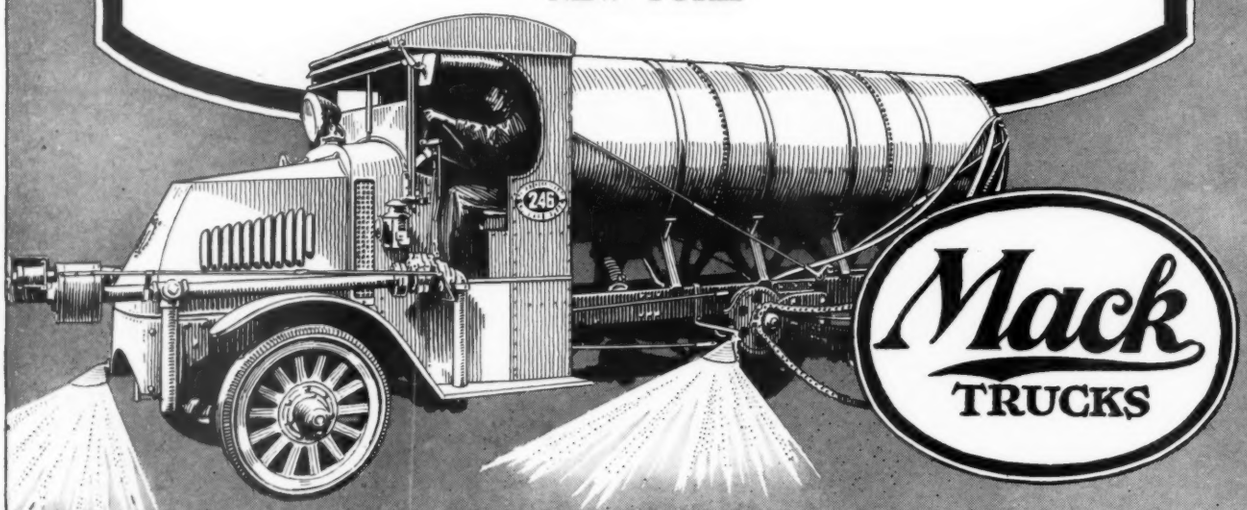
NEW YORK



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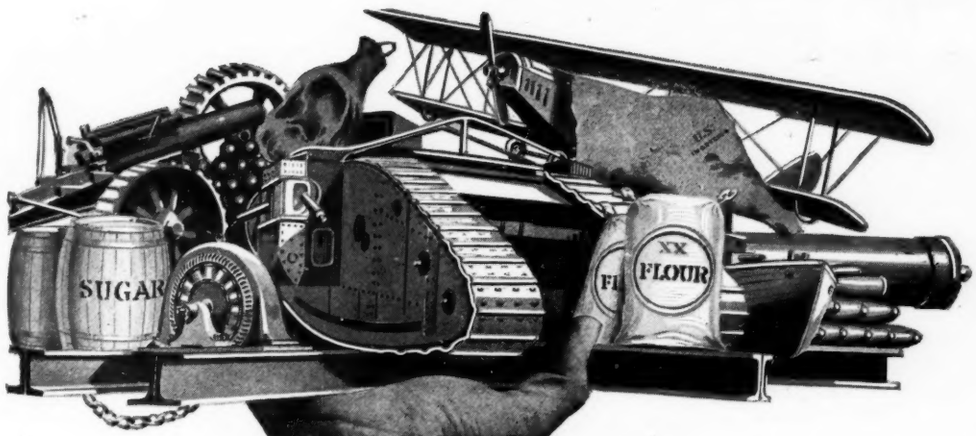
The Fighting Arm of Industry!



OPPOSED to the "mailed fist" is the mighty arm of industry.

Behind the Yankee machine-gunner, the man bucking a racketing riveter.

Back of the belching blast-furnaces, the roaring din of high-powered industry at peak load, the food supply, the farmer at the plow,

—stands transportation!

Underlying the whole scheme, the carriers must bear the burden to the panting workers.

Railways, waterways strain and tug at the load.

Both are primarily and directly dependent upon the highways.

The present uncertain condition of our highways makes it impossible for them to meet the burdens which they should bear.

Their neglect is serious and because of it we are paying a heavy penalty.

It is just as necessary to build permanent highways as it is to increase the efficiency of our railways and waterways.

No ***one*** of these great transportation forces is effective without the aid of the others.

All are allied in a common cause—the winning of the war and the meeting of conditions which will face our country afterwards.

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Manufacturers of Motor Trucks of 1, 1½, 2, 3½, 5 and 6 ton capacity
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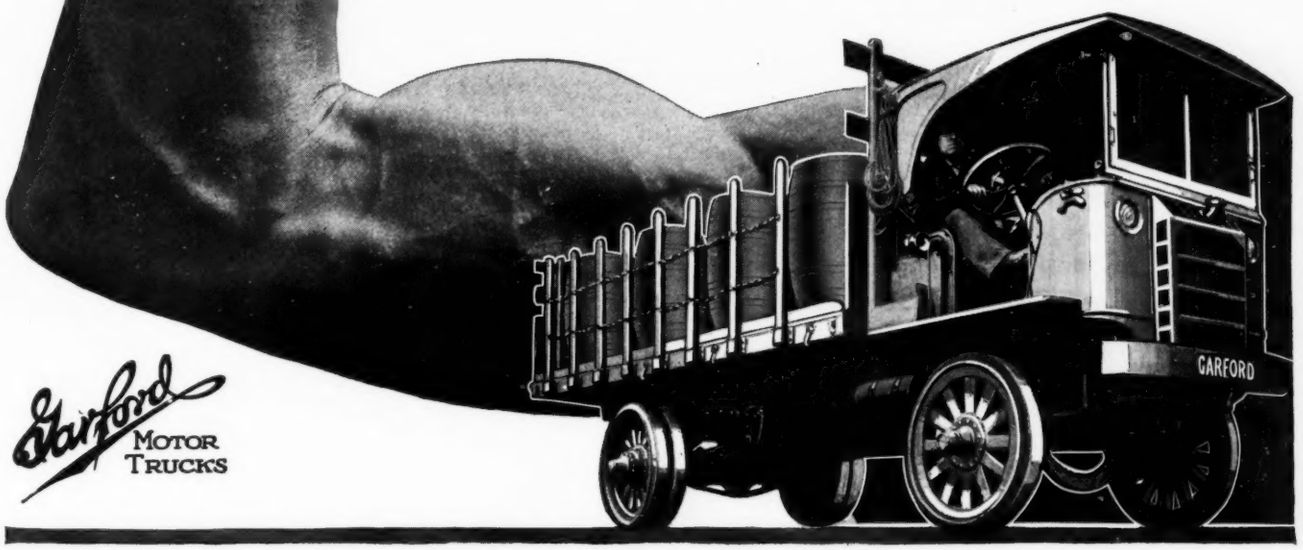
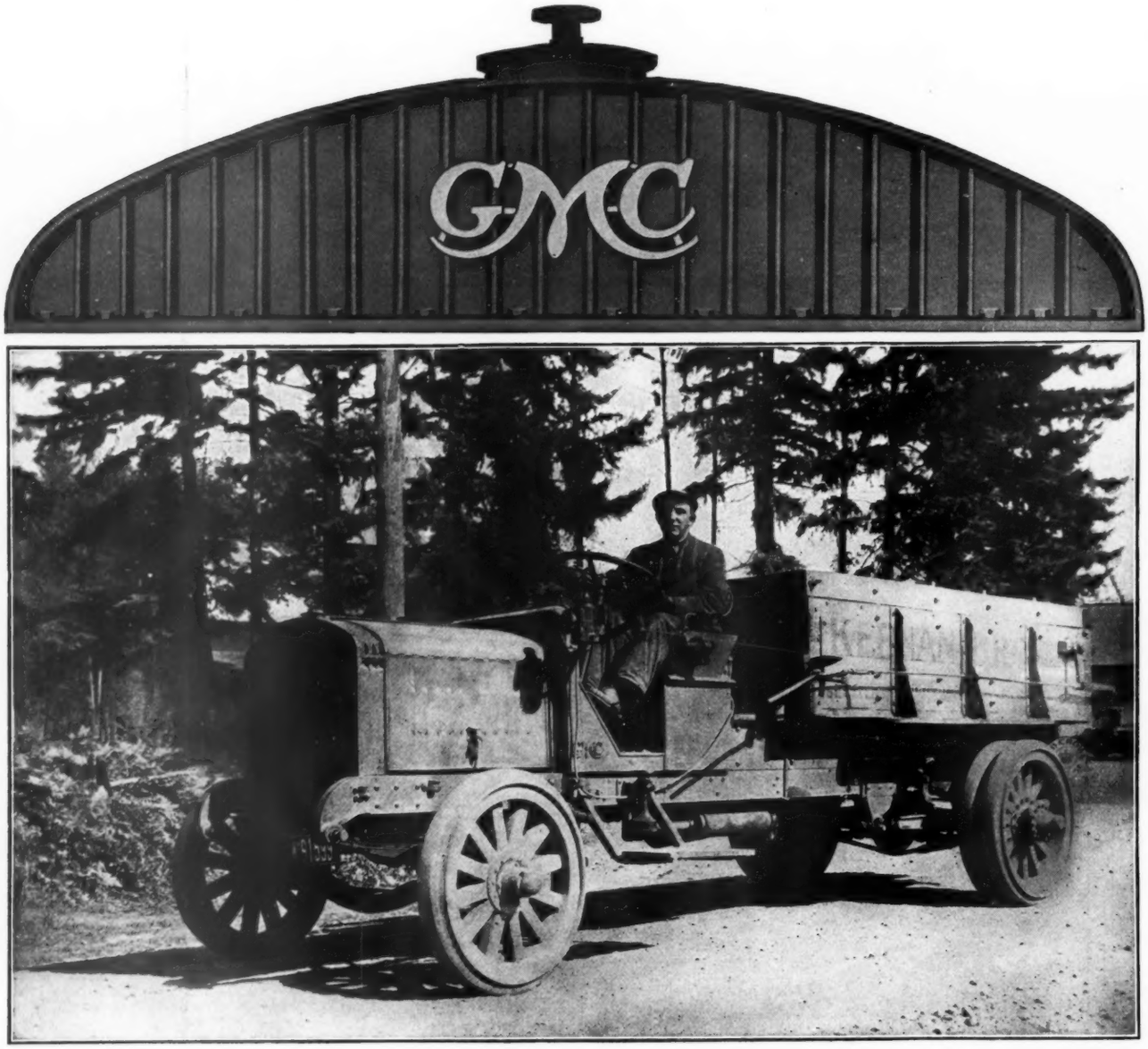


Garford MOTOR TRUCKS



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(404)

MOTOR TRUCK OPERATION AND ACCOUNTING XXXVII

During the next few months, at least, the most important application of motor trucks will be in the intercity and interstate haulage of freight on the highways. In recognition of that fact it has been decided to resume the series of articles on this subject which appeared in this section of the February, March, April and May issues.

Success of Motor Vehicle Parcel Post Service Instituted By Post Office Department

James I. Blakslee, Fourth Assistant Postmaster General, in a letter to the editor July 31, 1918, gives the following information on the value of Motor Vehicle Mail Service in handling mailable merchandise:

"The demand for better and more reliable means of intercommunication for the transportation of commodities, particularly food of local origin or production, and merchandise necessary or incidental to food production, induced the Post Office Department to institute the Motor Vehicle Mail Service. There are many contributing factors to the alleged high cost of living, none more important than the indirect or inefficient methods of distribution and defective avenues of transportation.

"Motor Vehicle Mail Routes extending out from the larger consuming centers into the surrounding producing territory afford direct means for the collection and forwarding, on quick and reliable schedules, of farm produce and any other mailable merchandise. The producer domiciled thereon is in immediate touch with the consumer and handling is reduced to the minimum.

"The individual operations involved in handling and rehandling, transferring, exchanging, and finally delivering costs but little, but are so numerous as to represent staggering sums when tabulated and charged to prices of commodities.

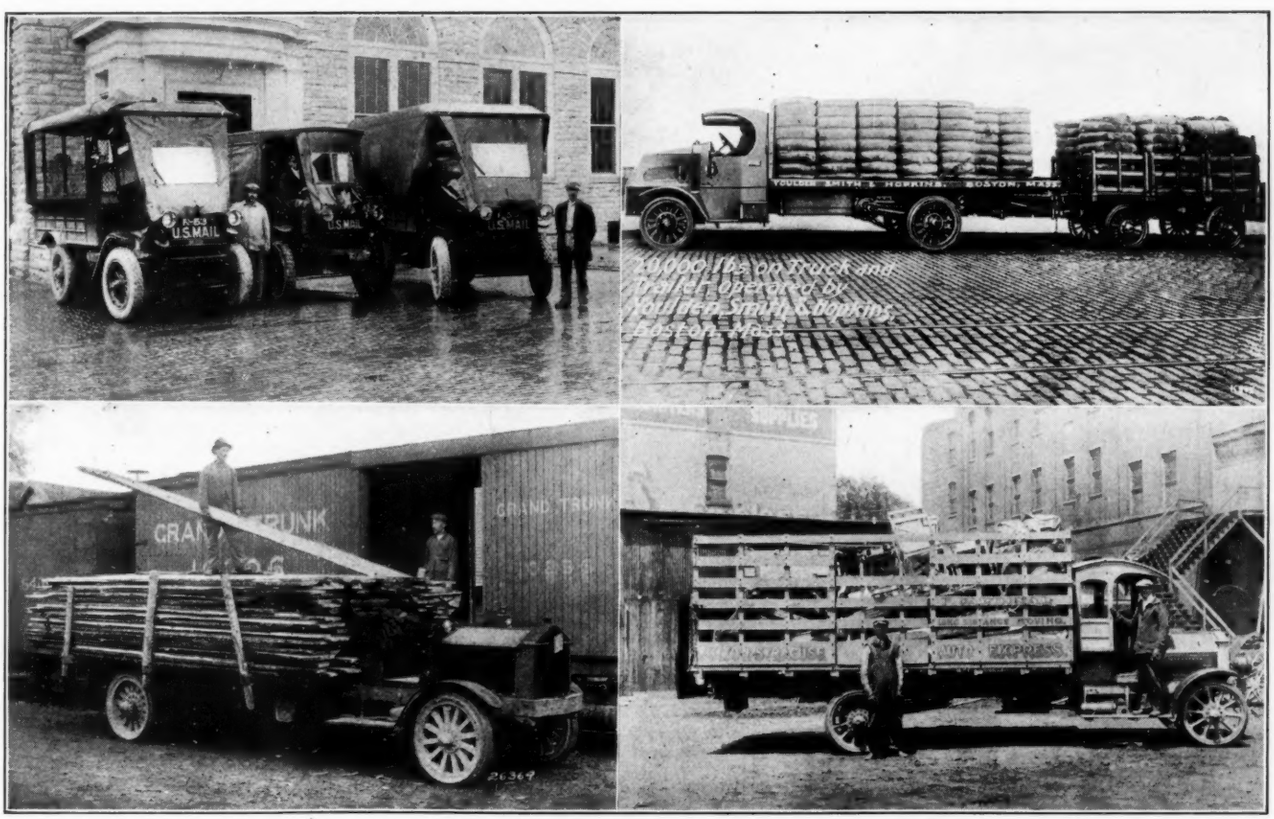
Earnings on Eight Routes

'On only eight routes operating during the month of June, 1918, there was earned $51,980.45 in postage. This number of routes has now been augmented by four additional, making a connecting or through service possible from Portland, Me., to Winchester, Va., and from Columbia, S. C., to Macon, Ga., via Savannah, Ga. Forty-seven trucks cover 1,733 miles of highways daily and will travel more than 2,000,000 miles a year.

"Further extensions of the service are contemplated as far as the limited appropriation will permit as rapidly as surveys can be made in promising localities.

Packages of 70 Pounds Accepted

"Let it not be supposed that only small or ordinary sized packages are to be carried, for a producer can ship by these routes a crate, or other receptacle, weighing as high as 70 lbs., and as many such containers as vehicle capacity will permit, to any point within 150 miles of the point of mailing, or,



MOTOR TRUCKS AS OPERATED IN INTERCITY AND INTERSTATE HAULAGE OF FREIGHT AND MAILABLE MERCHANDISE ON THE HIGHWAYS.

Three Autocar Trucks at West Chester, Pa., in Motor Vehicle Parcel Post Mail Service. Mack Truck with Trailer as operated by Youlden Smith & Hopkins Between Boston and Chelmsford, Mass. Hall 3½-Ton Worm Drive Truck Hauling Lumber from Maine Mill to Railroad. Federal Truck as Operated by Fulton-Syracuse (N. Y.) Auto Express.

Schacht Trucks Turn the Tide of Transportation Tie-Ups

Thousands of cars delayed—delivery held up—inestimable loss through late arrival of materials!

Every part of the country is now affected this way.

Only one solution—*Motor Trucks.*

Schacht Motor Trucks! Dependable! Quick! Steady! Economical!

IMMEDIATE DELIVERIES—2, 2½, 3½ and 5-ton capacities.

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G. A. Schacht Motor Truck Company

CINCINNATI, OHIO

New York Branch: 422 East 54th Street. **Chicago Branch: 2021 Michigan Avenue.**

DUPLEX FORDING A WESTERN STREAM IN HAULING FROM MINE TO RAILROAD.

DUPLEX TRUCK HAULING FOUR TONS OF SUGAR WITH THREE ADDITIONAL TONS ON TRAILER, A DISTANCE OF FIFTY MILES UP STEEP GRADES.

if beyond 150 miles, of 50 lbs. weight. In fact many shipments of cases of eggs have been made through this medium, and but recently about 90 cases of eggs were taken at one shipment from Emmettsburg, Md., to New York City, a road distance of 212 miles, and there safely delivered the same day. This is but a casual illustration of the character of service which may be performed.

Convenience to Postal Patron

"A very essential feature of this character of service is the complete convenience to the postal patron which is not alone confined to the establishment of direct mail facilities and improved highways over which the routes travel but also to provide patrons with data and information concerning the points where they can secure the best of products and commodities at the least cost, and to that end, the postmasters at offices on these routes will report to the Department each week the local prices received by farmers and producers for their commodities.

Data Compiled and Published

"It is intended to compile and publish these data, together with the names of the localities where they are produced, for the information and use of consumers.

"The first of these reports have been received from postmasters and show that on July 24 farmers residing at many points not farther than 25 miles, and in some instances closer, from the large consuming centers of New York, Philadelphia, Baltimore, and Washington, were obtaining the following prices: Eggs, No. 1, white 32@35; Eggs, No. 1, brown 30@35; Butter 32@37; Chickens, roasting or boiling, 25@35; Chickens, frying or broiling, 30@38; Potatoes $1.35@$1.50 a bushel.

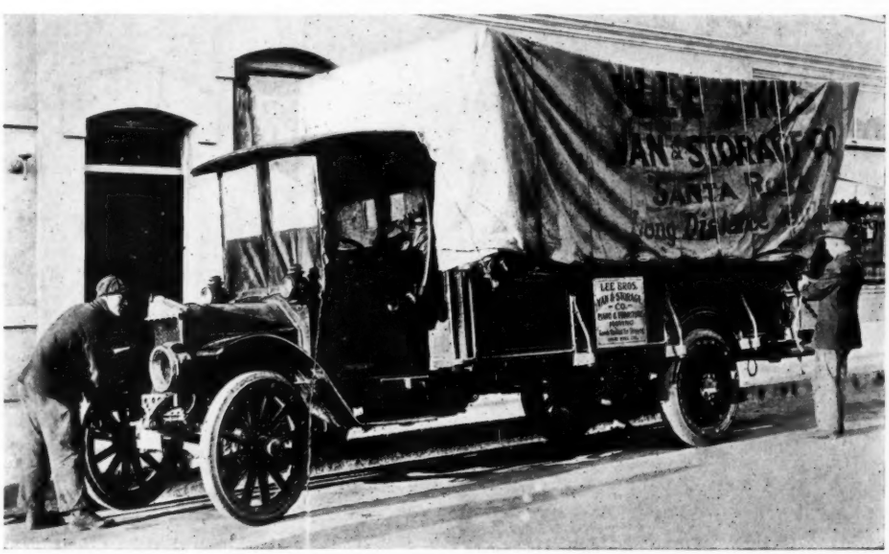
"On that date the market quotations for these commodities, wholesale prices, at New York, Philadelphia, Baltimore, and Washington, were within the following ranges: Eggs, No. 1 white, 39@52; Eggs, No. 1 brown 35@50; Butter 40@47; Dressed Poultry, roasting or boiling, 35@37; Chickens, frying or broiling, 47@50; Potatoes $1.50@$1.85. To get at the prices

SERVICE TRUCK, LOADED WITH OFFICE FURNITURE, EN ROUTE FROM CHICAGO TO TOLEDO, OHIO.

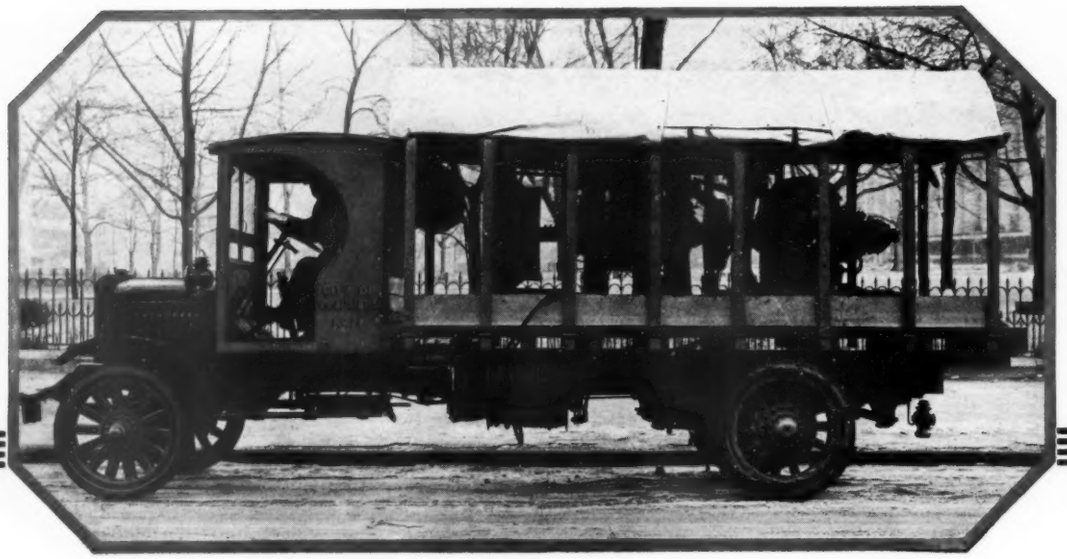
at which these commodities were sold to consumers, from 15 to 20 cts. should be added to the wholesale prices quoted on eggs, from 10 to 15 cts. on butter, and from 15 to 20 cts. on chickens, and from 30 to 50 cts. on potatoes.

Affect Producer and Consumer Prices

"The point sought to be brought out from a comparison



FEDERAL TRUCK OPERATED BY LEE BROS., SANTA ROSA, CAL., IN HAULING FURNITURE FOR SEVEN-ROOM HOUSE (6,750 LBS.) FROM GEYSERVILLE TO WILLOWS, CAL., A DISTANCE OF 233 MILES.



5 Models Service MOTOR TRUCKS **1 to 5 Tons**

For sprinkling, oiling, flushing, light and heavy hauling—for municipal work of any kind demanding absolute reliability.

In the Service Motor Truck there are no outstanding units. The entire truck is, mechanically, one harmonious whole of which no one particular unit can be featured.

Correctness of design and construction *proved* by its eight years' record on hauling jobs of practically every kind.

Capacity to deliver unusually dependable and economical service *proved* by its record on the cost sheets of over 200 different lines of business.

Its popularity with discerning business men is *proved* by a demand which has forced us to increase manufacturing facilities to provide for an output of 50 trucks a day.

A New Catalog containing information which every present and prospective buyer of trucks should have is now ready for mailing. A postcard brings it.

Information of special interest to municipal officials may be obtained by addressing

Service Motor Truck Company

Dept. M-3. **WABASH, INDIANA.**

Distributors in all principal cities.

FEDERAL TRUCK AS OPERATED BY SWEENEY BROS. ON NEW YORK-PHILADELPHIA FREIGHT LINE.

of the prices received by the producers with those paid by the consumers at once becomes apparent. It will be seen that the city consumer is paying about 10 or 20 cts. a dozen more for eggs, from 15 to 25 cts. a pound for butter, and from 15 to 20 cts. more a pound for chickens of the two grades.

"By using these routes, these commodities could be delivered direct to consumers at a cost above the local selling price received by the farmers of not to exceed 3 or 4 cts a dozen for eggs, 2 cts. a dozen to cover the cost of postage and packing and 1 ct. a dozen return postage on the egg conveyor, and not to exceed 2¾ cts. a pound on butter and chickens.

Very Considerable Saving to Consumer

"It will thus be seen that the individual saving in cost to the consumers is very considerable and that they would have the added advantage of obtaining their products strictly fresh and without inconvenience, while the producer would not have to wait the call of the huckster to dispose of his products or to leave his work and drive to the nearest town to dispose of them.

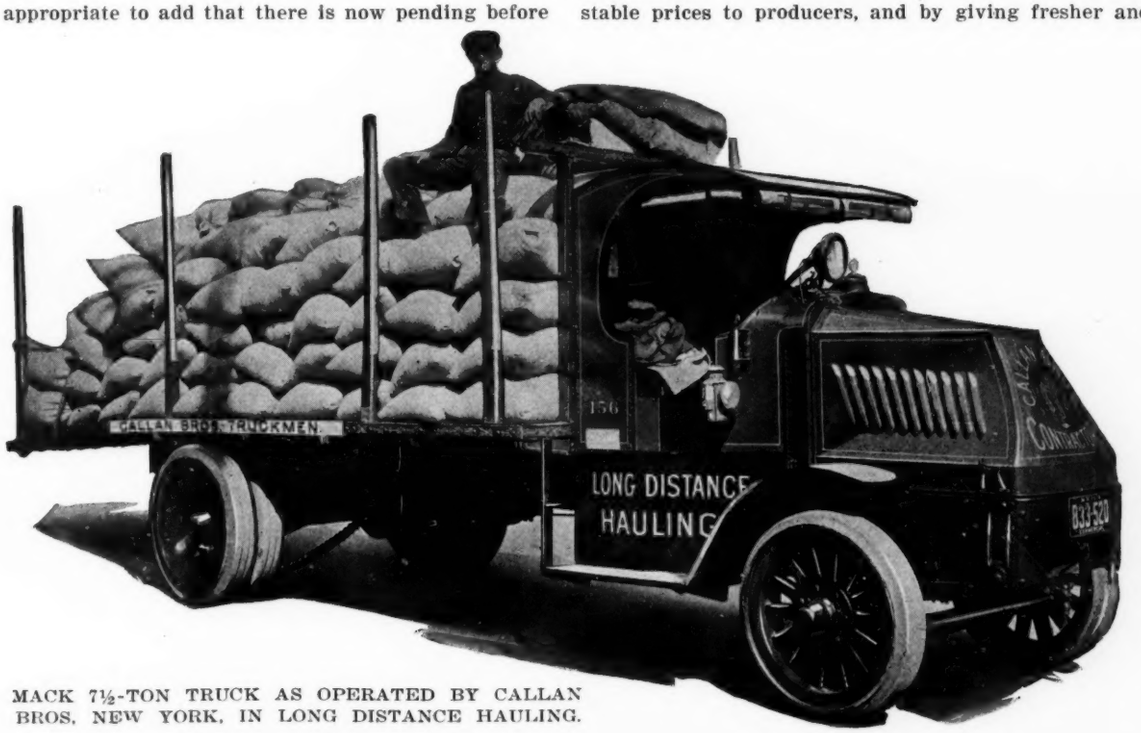
Earnings to be Used in Part for Road Construction and Maintenance

"It is appropriate to add that there is now pending before Congress a proposition authorizing the Postmaster General to expend not more than 50 per centum of the gross earnings of the Motor Truck Mail Service for the construction and maintenance of the highways on which this service is or may be established.

"The view is taken that the use of the highways by Government-owned equipment for such profitable enterprise without compensation to the State or such divisions thereof, except improved mail facilities to the residents domiciled therein, is neither equitable nor just.

"Through the medium of these funds, the construction of the proposed through or connecting route highways is in no wise intended to replace or otherwise interfere with the existing system of construction, whereby the States in conjunction with the Federal Government are building many miles of excellent road. It can readily be seen that with the extension of these routes and the constantly increasing revenues which they will bring that a vast amount of road building and improvement can be accomplished.

"From every point of view, the Motor Truck Mail Service is beneficial to the users, by insuring a reliable market and stable prices to producers, and by giving fresher and better



MACK 7½-TON TRUCK AS OPERATED BY CALLAN BROS. NEW YORK, IN LONG DISTANCE HAULING.

"It's a Bear for Power"

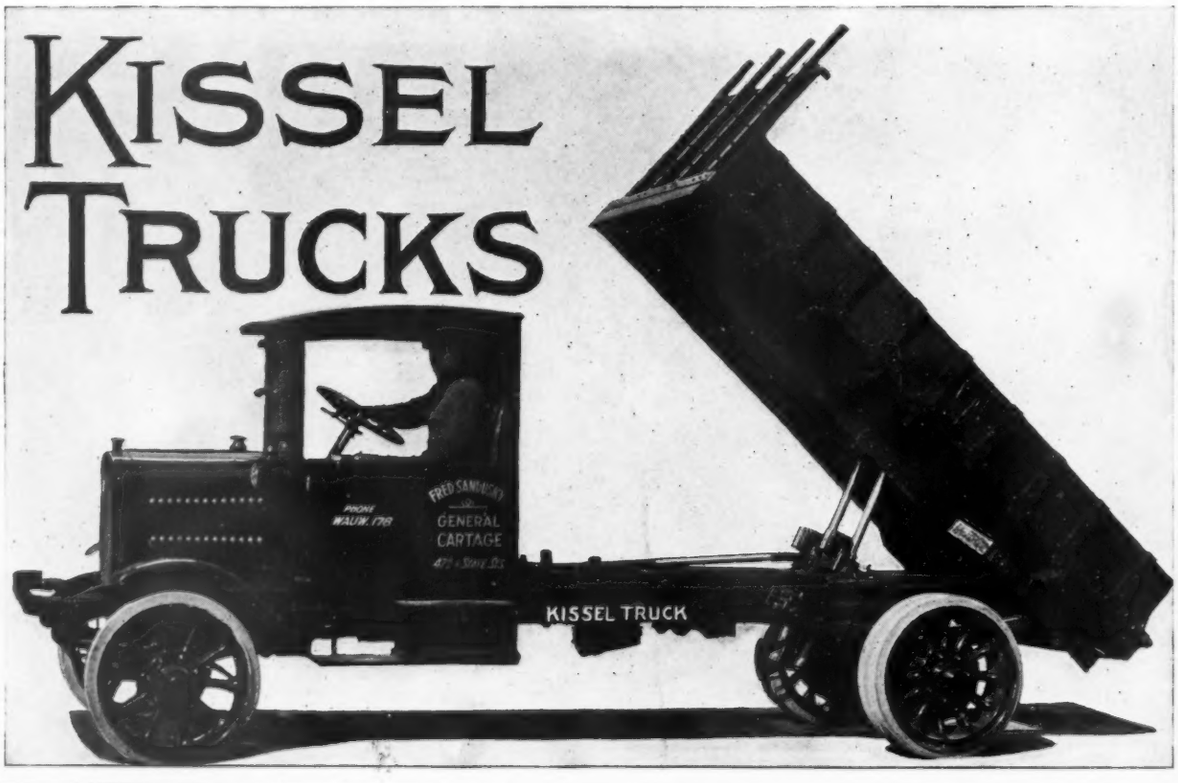
"I am using my Kissel Truck to haul gravel out of a pit and it is sure making good. I am in competition with other makes of trucks on this job and my Kissel pulls through where the other trucks get stuck. It's a 'bear' for power."

—A prominent Kissel Truck owner.

Kissel Trucks are built to give the uninterrupted performance necessary in the contracting, road-building and other municipal work. The perfected worm-drive rear axle, superior front axle, Kissel-built motor, frame, springs, brakes—every moving or fixed unit—are designed and constructed to give 100% efficient service.

KISSEL MOTOR CAR CO., Hartford, Wis., U. S. A.

Investigate Kissel Truck performance for other contractors and municipal commissioners, or see nearest Kissel dealer



DENBY TRUCK AS OPERATED BY THE GREENOUGH-HURLEY CO., IN INTERCITY HAULAGE BETWEEN PACIFIC COAST CITIES.

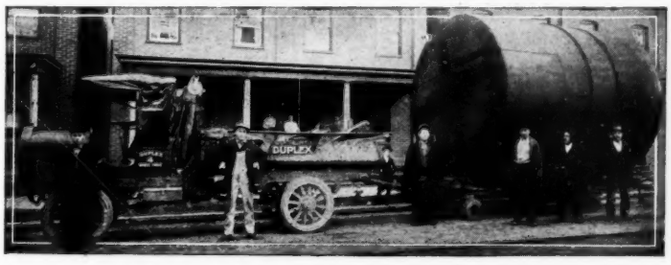
food products to the consumer at reasonable cost, and the Government gains through the increased revenues thus obtained.

"The successful culmination of this attempt to enlarge the avenues of conveyance and improve the means of communication will embrace three distinct phases of National development. The further introduction of the modern motor vehicle, the improvement of the highways, and a definite system of prompt and sure communication between producer and consumer, merchant and customer or source of supply and point of consumption. The vehicle is available, a specific suggestion for highway construction now before Congress is open to criticism and this Department will now concern itself with the last and by no means least important feature—'The Commercial Convenience of the Patron'."

Two Examples of Federal Trucks in Intercity Haulage

The J. A. F. Express Co., Toledo, Ohio, is operating several trucks in intercity freight haulage. One of these trucks is a 1-ton Federal that makes regular trips through Ohio and up into Michigan, to Detroit. Some of the towns visited with more or less regularity, are Bowling Green, Cleveland, Columbus, Fort Wayne, Detroit, Blissfield, Finlay, Williamstown, Sandusky and Fremont. Their price for hauling these various distances is one dollar per mile but if a return load is secured, this price is greatly reduced. Needless to say, their return trips are very seldom made without a load. This truck has traveled 2,000 miles a week for over nine months and they have not spent ten dollars on repairs as yet.

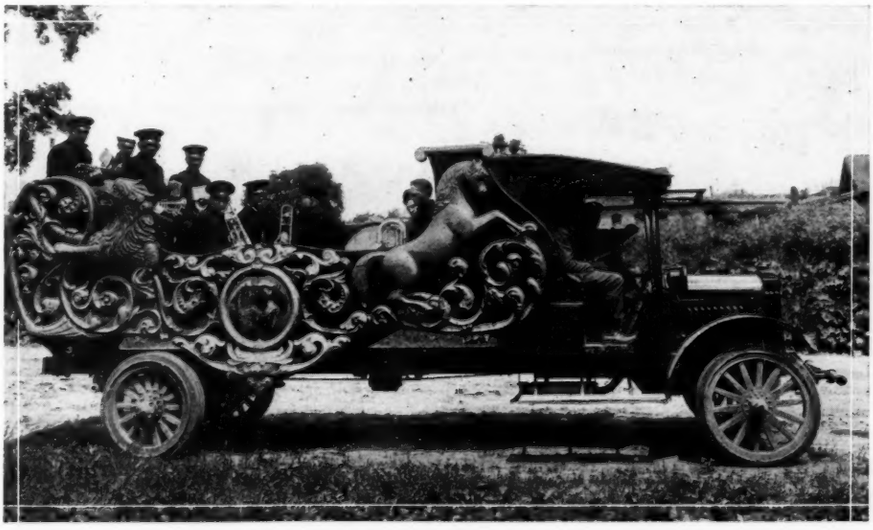
Frank Cardinal operates the Fulton-Syracuse Express line in New York. Regular trips between these two cities are made, hauling empty shells to Fulton and loaded ones back to Syracuse. These trucks also haul considerable other freight.



DUPLEX TRUCK HAULING 12x14-FT. OIL TANK FROM STROUDSBURG TO ALLENTOWN, PA., A DISTANCE OF THIRTY-EIGHT MILES.

Prominent Concerns Using Mack Trucks in Intercity Haulage

To show, in the briefest possible space, the extent to which intercity motor haulage has developed there is here given a list of a few of the more prominent concerns operating trucks

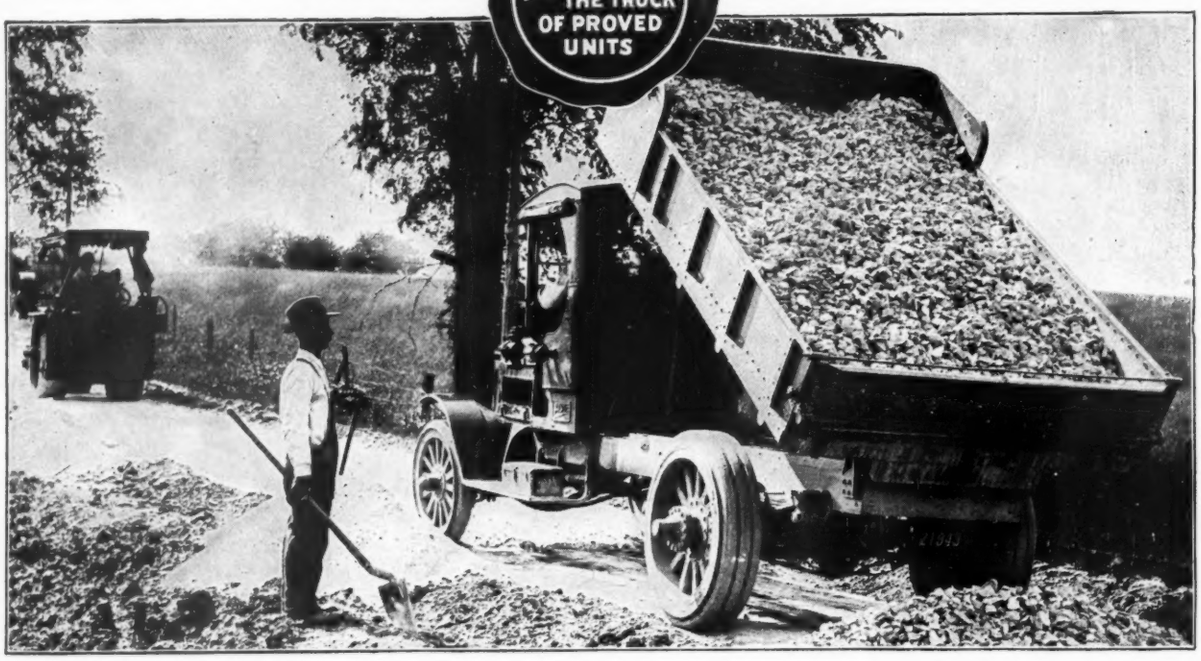


ONE OF THE FLEET OF SERVICE TRUCKS CARRYING THE COOP AND LENT'S CIRCUS FROM CITY TO CITY.

The Seal of Dependable Service

ACME THE TRUCK OF PROVED UNITS

Trade Mark Registered United States Patent Office



Engineers Agree on These Facts

Engineers the country over agree that the best way to build a piece of machinery is to take units that are accorded the highest degree of perfection in that particular industry and without consideration of cost bring them together in a single machine.

That, the best authorities state, is the method of building the world's finest machine in any line of business.

And that is the way the Acme Motor Truck was created and built. Such units as you knew to be the best in the truck world were brought together ***without consideration of cost*** and built into a single truck.

Continental, Timken, Borg & Beck are some of the names that represent the proved units of Acme motor trucks. Study the list presented herewith and if you want to judge in advance the truck for you to buy, the way to do it is the selection of the Acme.

Write for our book, ***"Pointers to Profits."***

ACME MOTOR TRUCK COMPANY

Capacities: 1, 2, 3½, 4 tons.

313 Mitchell Street, Cadillac, Michigan

ACME

REG. U.S. PAT. OFF.

The Truck of Proved Units

ACME PROVED UNITS

Continental Red Seal Motor	Detroit Springs
Timken-David Brown Worm Drive	Stewart Vacuum Feed
Timken Axles	Artillery Type Wheels
Timken Bearings	Truck Type Radiator
Borg & Beck Clutch	Eisemann High Tension Magneto
Rayfield Carburetor	Ross Steering Gear
Cotta Transmission	Blood Bros. Universal Joints
Centrifugal Type Governor	

of the same manufacture, namely Macks, in this class of haulage:

Brocklehurst & Potter Co. will operate approximately 100 Macks between New York and Philadelphia; Sheehy Trucking Co., Shelton, Conn.; operate from points in Connecticut, to and from New York; Murphy Transfer Co. and Wright-Barret & Stillwell Company, St. Paul, Minn.; operate between Minneapolis and St. Paul; Youlden, Smith & Hopkins, Boston, Mass.; operate between Boston and Chelmsford, Mass.; Wilkes-Barre & New York Motor Carriers Company, Wilkes-Barre, Pa.; operate between Wilkes-Barre, local Pennsylvania and New Jersey points, into Paterson, Newark and New York; New York-Springfield Dispatch operate between Springfield and New York; A. J. Reach Co., Philadelphia, Pa.; operates between Philadelphia, Middleton, and Elkton, Md., a distance of approximately 100 miles; Mutual Hauling Company, Cincinnati, Ohio; operates from Cincinnati to Covington and Newport, Ky., and Hamilton, Middletown, Dayton, Xenia and Columbus, Ohio; Benjamin Hershfield, South Norwalk, Connecticut; operates six trucks between Brooklyn, N. Y., and South Norwalk, Conn.; Goodyear Tire & Rubber Co., Akron; operates between Akron, New York, Philadelphia, and Boston; and the Inter-State Motor Van Service, Brooklyn, N. J.; operates between New York, Bridgeport and Philadelphia.

The freight embargo on New England threatened to paralyze the S-K-F Ball Bearing Company of Hartford, Connecticut.

FLEET OF MACK TRUCKS AS OPERATED BY THE WILKES-BARRE & NEW YORK CARRIER CORP.

This Freight Line Handles from Twenty to Forty Tons Daily, Largely Government Materials, Between Pennsylvania and New Jersey Cities and New York City.

Forty-four tons of urgently needed raw material lay on the New York docks, 140 miles away. The railroads couldn't haul it. The factory couldn't run without it. In this crisis the S-K-F managers called on the Heavy Haulage Company of New York. The Haulage Company responded by putting five 5½ ton Mack trucks with trailers on the job. When the next day broke the forty-four tons were at the S-K-F plant. The trucks had made the 140 mile haul overnight.

Hall Trucks in Intercity and Interstate Haulage

A Philadelphia motor service company has a contract with two large packers for the delivery of meat to New York City. This run is made by night in 12 hours in order that the meat may be marketed in New York in the morning. This company, operating Hall trucks, has been able to maintain its schedule even under the most severe handicaps.

A Boston bottle company likewise employs several 3½-ton, worm drive type, Halls in hauling its product to Hartford, Conn., a distance of 138 miles, to Providence, R. I. and Brockton, Lynn, Salem and Fall River, Mass. The trucks are equipped with exceptionally large bodies and are capable of carrying a load of 85 barrels of bottles. These runs are made on a surprisingly low fuel allowance.

Beitchman's Moving Vans, Brooklyn, N. Y., operate a Hall truck for long distance trips and have made runs as far as Springfield, Mass., without difficulty.

The S & K Trucking Co., Detroit, hauls material and supplies for the Government to the aviation field at Mt. Clemens, Mich., a distance of 22 miles, and their experience, has been most favorable.

DART TRUCK CONVEYING TRUCK FROM SEDALIA, MO., TO PITTSBURG, KAN., A JOURNEY OF 250 MILES OF MUD AND WATER.

Bert J. Wesley, in the trucking line in Detroit uses a 5-ton worm type drive "Hall" for hauling freight to Wyandotte, Pontiac, and other nearby towns, within a radius of 50 miles, and advises that he gets six to eight miles to the gallon of gasoline.

The Chas. Uelsman Co., engaged in the pickling business, operate a 2-ton chain drive truck, and claim they get from 10 to 11 miles to the gallon of fuel. They further state that each of these trucks takes the place of two teams. This concern also makes runs to towns within a radius of 50 miles of Detroit.

Duplex Truck with Trailer Hauls 7 Tons 50 Miles at 4 Cts. Per Ton-Mile

With an average cost per ton-mile of 4 cts., a Duplex 4-wheel drive truck recently made a remarkable economy record when it carried four tons of sugar and hauled three additional tons on a trailer a distance of 50 miles up stiff grades.

The truck and trailer hauled the 7-ton load from the Warner Sugar Refinery, Edgewater, N. J., to the warehouse

of the Union Pacific Tea Co., at Paterson, and but seven gals. of gasoline were consumed on the trip.

The route included Fort Lee hill—one of the most universally cursed climbs for motor vehicles in the country. It's a mile long and has grades up to 17 per cent. The lower part of the climb abounds in deep chuck holes; the middle is a mass of soft asphalt; the top section is rough cobble stones. As good measure there's a hair pin turn on the last lap.

The Duplex hauled its load up this hill in 12 minutes. Made the climb without difficulty, although in places the truck sunk in the soft asphalt 2 ins.

Acme Trucks in Intercity Haulage

Acme trucks are widely used in intercity haulage. Examples will be drawn from Texas. These trucks are operated on well-established freighting routes between Dallas and Ben Wheeler, Dallas and Lewisville, Dallas and Waxahachie, Dallas and Fort Worth, etc. The basis of rates is most commonly figured at 1 cent per 100 lbs. per mile on direct intercity hauling, according to Messrs. Fulton & Felix, Acme distributors in the Dallas district.

A. M. Perry operates a 2-ton Acme in freighting between Dallas and the following cities: Mesquite, Terrell, Forney, Elmo, Cobbs Switch, Wills Point, Myrtle Springs, Canton and Ben Wheeler, a distance of 76 miles. He hauls loads of 6,000 lbs. to 7,000 lbs. with his 2-ton truck. On a recent occasion the bridge was out at Mesquite, and he had a load of 15 bar-

GRAMM-BERNSTEIN TRUCK HAULING BUILDERS' TILE AS OPERATED BY THE L. W. CAMP CO., AKRON, OHIO.

rels of oil weighing 6,255 lbs. He had to drive nine miles around, through plowed fields and freshly graded lanes. He made the distance loaded, in high and second, never going into low gear. He gives his gasoline mileage at 8½ miles to the gallon. That he is an enthusiast over the performance of his Acme may be gathered from his statement that he can pull any office building in Dallas, under 22 stories high, if the corners are first loosened.

The Seeing San Antonio Company operates two Acme trucks between San Antonio and the aviation grounds and cantonments. Every night these two trucks carry large numbers of soldiers from Camp Travis and Fort Sam Houston to the city and back. These trucks also make trips out as far as Medena Lake, a distance of 35 miles.

Trucks Operated in Conjunction With Interurban Electric Lines

The Interurban Motor Despatch, under the management of W. T. Gridley, was recently incorporated and closed contracts with the interurban electric railways entering Chicago to establish an express and fast-freight service over their lines, and a large central freight station, in the downtown section of Chicago, for the receipt and delivery of freight and express matter and in connection therewith a line of motor trucks for the transporting of express and freight matter from the central freight house to the electric railway company's freight terminal. This service will be in full operation very soon. The express rates will be considerably lower than the present ones, while the freight rates will be a trifle higher than steam railroads, which will be offset by a prompt and efficient service. Freight delivered to the downtown freight station up to late evening will be ready for delivery in the suburban cities by 7 o'clock the next morning. A full force of competent solicitors and freight handlers will be employed. Gramm-Bernstein trucks, exclusively, are to be used in this service, because of their low operating costs. The original purchase of Gramm trucks for this purpose comprises ten 3½ and 5-ton trucks.

Intercity Motor Express Line Out of Chicago

The highway transportation service of the Intercity Motor Express Line from Chicago to Elgin, Aurora and intermediate Illinois towns, was recently inaugurated. A regular daily schedule is arranged for trucks to leave the Chicago station, 4638 West Madison street, at 8:30 a. m. The route over the highway to Elgin is 55 miles. This rural motor truck line, on payment for haulage same as express, will receive and deliver at all intermediate points.

Spur lines will run from Elgin to Rockford and intervening points. Agents at convenient distances along the route will attend to rural or farm orders and keep drivers informed of where 'pick-ups" are in order that the schedule may be maintained. E. H. Lowe is manager.

Four 2-Ton Trucks Equal to One Freight Car in Ton-Mile Capacity

L. A. Peil, Chicago distributor of the Selden truck, estimates that on the basis of actual performance in many tests already made four 2-ton motor trucks prove conservatively equal in ton-mile capacity to one freight car. Official railroad figures give freight car ton-mileage as 40 tons average load carried 20 miles per day, which is equivalent to 800 tons carried one mile.

The four trucks, on the other hand, have a carrying capacity of 8 tons instead of 40, but their mileage will approximate 100 miles per day instead of 20. This is equivalent to carrying 800 tons one mile. That is, the ton-mileage is the same as that of one freight car.

That the estimate of 100 miles a day for the motor truck is conservative is proved by the actual performance of a caravan of five heavy trucks which recently made the trip from Akron to Chicago, thence to Baltimore, a distance of 1,260 miles, carrying capacity loads of freight. The trip was made over unfamiliar roads, yet the actual running time was only 75 hours, which gave an average speed of 17 miles per hour. For an 8-hour driving day this would amount to 136 miles a day. Furthermore, it requires 25 tons of steel to build a freight car, but only about 6 tons to build four motor trucks.

Progress of Intercity Motor Haulage

Intercity motor haulage has made rapid and gigantic strides during the past year; what was then something of a commercial novelty is now a recognized and indispensable part of the nation's transportation system.

In a recent issue of *Current Affairs*, the weekly newspaper of the Boston Chamber of Commerce, there was noted the advertisements of 14 haulage companies engaged in the intercity and interstate haulage of freight on the highways. This is positive evidence of the well-established status of motor-transportation in New England. This is but an illustration of a condition that is rapidly attaining permanency in the neighborhood of all large cities, and motor transport lines are being constantly thrown out to greater and greater distances from these big centers of business and population.

A New England Motor Transportation Company

Huckins & Co., Inc., 46 Clinton St., Boston, Mass., engage in motor transportation. In a letter to the editor they write as follows:

We have standardized our equipment, operating at present three 5-ton Pierce Arrow trucks for heavy, long distance hauls and five 2½-ton Autocars for light local work. From a truckman's point of view as regards service, maintenance and appearance we feel these two types to be without a superior in the truck field.

"Our trucks travel from Boston regularly to Providence, R. I., Portland, Me., and New Haven, Conn., over roads suitable for tourist travel all the way. These roads are well kept and in good order.

"We find long distance hauling to be the best proposition for a truckman to handle, for with the co-operation of the various return loads bureaus now coming into active service through our territory an empty truck one way is a rarity and a truck loaded both ways is a money maker.

"Kindly note us as enthusiastic over motor transportation if handled efficiently, and with due regards towards your customer it offers a large field of endeavor, with success in view at all times."

Ninety 3-Ton Trucks in 981-Mile Cross-Country Run

The largest truck train movement yet undertaken by Uncle Sam recently reached a successful ending at Camp Jesup, Georgia, when 90 3-ton Packard trucks completed a 981-mile cross-country journey from Detroit.

Not only was the trip remarkable on account of the distance and the length of the train—but much of the country traversed was unsuited to such traffic and the soldier-drivers had to strengthen and rebuild dozens of bridges along the route.

At Guntersville, Ala., where the swollen Tennessee river had to be crossed only a one-man ferry, capable of carrying a single truck was available. This diminutive transport required two hours for each round trip and would have necessitated a week's night-and-day effort to put the train on the far bank. So, moving several miles down the river, a railroad ferry accommodating 18 trucks was commandeered and after a suitable approach was built, the long caravan put the stream behind it in little more than a day's time.

Despite many such difficulties the trucks rolled into Camp Jesup 17 days after leaving the Packard factory, every truck in fighting trim.

Dump Truck Powered with Wisconsin Motors

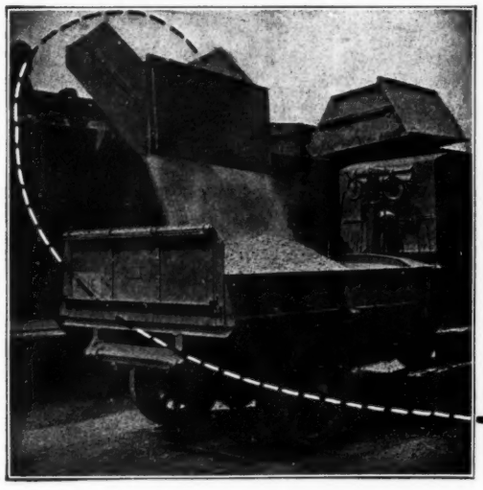
CONSISTENT

The standard power for municipal trucks

Write for specifications on different types and sizes.

WISCONSIN MOTOR MFG. CO.
Station A. Dept. 330
MILWAUKEE, WIS.

New York Branch,
21 Park Row,
T. M. FENNER, Factory Rep.



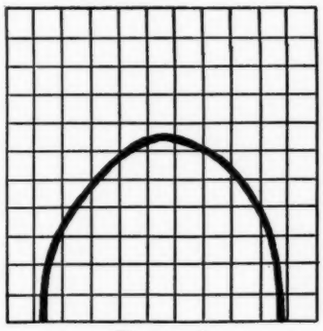


Diagram 1.

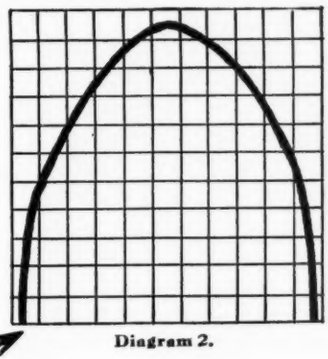


Diagram 2.

Three times the unloading capacity—with fewer shovelers—by using the Heltzel "Lightning" Loader Skip.

Diagram 1—shows your *present* capacity for unloading if you are not using the **Heltzel "Lightning" Loader Skip.** This *handicap* delays your trucks, delays the job, keeps the men loafing, and piles up on your account *$10.00 per day* demurrage charges!

Diagram 2—shows *three times* your capacity for unloading if you *use* the **Heltzel "Lightning" Loader Skip.** This advantage permits you to keep only a few shovelers busy *all the time,* keep the trucks actively moving and *hasten the work!*

Moral*—Speed up your unloading and save time and money with the Heltzel "Lightning" Loader Skip. *Read our illustrated literature.

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO.

Reliability! Keeping out of the repair shop! No "*getting out and getting under*" to locate unknown knocks, noises and squeaks. You *never* see a **Hall** Truck laid up. Because **Hall** Trucks are built by *structural iron workers* of forty-five years' experience—by skilled automotive engineers who have combined *Timken* axles and bearings, *Continental* motors, *oversize* springs, *extra-strong* axles, *extra-long* frames and other big truck features to such mechanical perfection as to *eliminate absolutely* all rattle, stress and strain!

Reliability in **Hall** Trucks has registered 100% where *reliability* is most *needed*—in hauling heavy loads over bumpy roads, grade crossings and cobblestones. *Reliability—dependability*—good, steady, efficient operation with low maintenance! That's what makes for economical truck service—the kind that all contractors seek—the *only* kind you get in **Hall** Trucks!

"Haul it in a HALL!"

THE LEWIS-HALL IRON WORKS

Manufacturers of the HALL Truck
(Established 1873)

Ferry Avenue and Grand Trunk Ry. **DETROIT, MICH.**

New York Distributors: Robert D. King & Co., Inc., 221 W. 64th St., New York City, Metropolitan Dealers,
New England Distributors: Hall Motor Truck Co. of N. E., 1123 Commonwealth Ave., Boston, Mass.,
Guarantee Automobile Exchange, 629-31 N. Broad St., Philadelphia, Pa., Philadelphia Dealers.

EDITORIALS

For a Supreme Federal Highway Commission

The need for a supreme federal highway commission, with a personnel fully informed on the economics of highway transportation, is imperative. The men appointed to membership on this commission must, first of all, believe in the military and commercial value of hard-surfaced roads; they must think roads, they must advocate roads, they must realize that roads are essential. With such a body to lead and correlate all road planning agencies, of whatever nature, we shall secure quickly a rational plan for a comprehensive system of improved highways throughout the entire country. Under the leadership of this supreme federal highway commission an informed public opinion will develop pressure which will insure the prompt construction of the roads of primary importance, and the early construction of roads of secondary military and commercial value.

Every close student of the American highway problem now realizes that without well defined leadership of this character, the good roads movement will continue to bog down like a motor truck carrying urgently needed war materials over a mud road. For a while last spring it seemed that the United States Office of Public Roads and Rural Engineering might rise to the occasion and assume forceful leadership in all highway matters, but this hope was disappointed. The activities of that office have their statutory limitations. Again, many hailed the formation of the United States Highways Council as an indication of a change in the attitude of official Washington toward road construction in war time. This is not the case. The creation of this council merely centralized the agencies which have been imposing restrictions on highway improvements. Before the formation of this council it was necessary to peddle a road improvement project from one department to another, thus consuming much time and energy. A project now goes to the council where, theoretically at least, it receives final disposal on behalf of the various department boards, bureaus, councils, committees, etc., who previously gave it attention separately. This is an improvement in the highways situation, without doubt, but at best it is no more than better co-ordination of the various restrictive agencies. It should be definitely understood that the United States Highways Council was not organized for the vigorous prosecution of highway improvements. It is, and always has been, a restrictive body and presumably it will remain a restrictive body until the fundamental policy toward road improvement is changed. It is only another judge. It is not an advocate. The situation demands a supreme advocate of highway improvement to speed up the rational and immediate development of highway transportation, involving the formulation of a comprehensive plan for a system of trunk and feeder highways and the construction of these highways as soon as possible.

What is needed, and needed most imperatively, is the immediate creation of a supreme federal highway commission that shall rank with the Railway Administration and the Emergency Fleet Corporation. Road building must be prosecuted with the enlightened vigor being shown in shipbuilding.

Highway transportation is basic. What is eventually shipped overseas must first be hauled over the railroads and to the railroads, from the point of production, over the highways. Take the case of food which, we are assured, will win the war. Farmers are straining every nerve to increase the production of food, yet not one single thing has been done in the way of road improvement to aid the farmers in distributing what they produce. Much food is interned on the farm because of poor road conditions in the natural marketing season. At this instant there are many hundreds of thousands of bushels of 1917 corn in the cribs of Illinois farmers. Last winter and spring when the farmers had time to haul this corn to town they couldn't because of the impassable condition of the mud roads of this tremendously wealthy state. Now what is the immediate prospect for road improvement in Illinois? Precisely this: At the general election in November the people of the state will vote on the issuance of $60,000,000 of bonds to defray the cost of a state-wide system of durable, hard-surfaced roadways upon the public highways of the state, comprising 46 separate and distinct intercity routes. But that is but the rotation of the legal machinery, long since set in motion. The governor of the state has urged the approval of the bond issue but has made clear his intention to defer construction of these urgently needed roads until after the war! The inconsistency of the official attitude towards road improvement work in war time was never better or more unfortunately illustrated.

The supreme federal highway commission should be created by Congress at once either on its own initiative or that of the President. This commission must be granted broad powers and adequate funds. It should be so constituted that it can make a quick survey of the immediate and prospective requirements of highway transportation and should be given mandatory powers so that it can order federal, state, county and township road funds expended on the improvement of prescribed highways which shall link together to form a comprehensive national road system. The commission should be in position to augment local funds where necessary to speed up the construction of local roads.

After a thorough trial of the economic feasibility of motor trucking mailable merchandise over the highways the postoffice official in charge of this work gives it his unqualified endorsement on the broad grounds of giving the producer a better and steadier market and of bringing to the consumer produce of an improved quality at a decreased cost. Thus the federal government itself has demonstrated the great value of highway transportation in war time. A bill is now pending in Congress to authorize the expenditure of 50 per cent. of the profits of the motor parcel post service for road repairs and new construction on the routes traversed. This is convincing evidence of the value of highway transportation in war time, and it is submitted by a major department of the fed-

eral government. But this new federal endorsement of highways is only heaping measure; for many months the national government, through some of its departments, has been falling back on the highways to make good the inadequate service obtainable from the railways. At the same time other federal agencies have hampered road construction at every opportunity. Sometimes road work has been forbidden; at other times it has merely been made impossible through one or more restrictive orders.

This incongruous condition has existed much too long. Let us have done with this off again, on again, gone again, Finnegan method of regulating highway transportation.

The bankers on the Capital Issues Committee are throttling highway transportation. They appear to think that the moment a dollar is spent for road building it goes permanently out of circulation, that its usefulness has terminated. This view indicates a total lack of understanding of the use and power of money. But these gentlemen are obdurate; their minds are firmly made up and, unfortunately, they are made up in the conclusion that road building in war time is a non-essential. The individual can scarcely hope to change this opinion even if he is permitted the opportunity.

In general, it may be concluded that no adequate relief from this unwise restrictive policy can come from existing government agencies. The logic of the situation clearly calls for the creation of a federal highway commission of such standing and with such powers that it can meet on equal footing the obstructionists of highway transportation and convince them of the great disservice they are rendering the nation in suppressing highway improvements.

Such a commission, armed with its meritorious cause and backed by an enlightened public opinion, will overcome all resistance and will build the roads we need; roads that we need now and will need for an indefinite period in the future.

Are Good Roads Essential?

If any considerable headway in road improvement is to be made during the war it is first necessary to convince official Washington that good roads are essential. The question is not one of money, as many suppose, but entirely one of opinion, so far as the Capital Issues Committee is concerned. It is well to understand this point.

Recently a worker in the construction field discussed with an Ohio banker the attitude of the Capital Issues Committee toward highway improvement during the war. This banker presented the view of the bankers. In defense of their stand he made the statement that if his best customer were to come into the bank that day and ask for $100,000, the bank would refuse the loan. He admitted that it could be secured from the Federal Reserve Bank upon a day or two notice, discounting the bank's own note. He finally admitted that **if official Washington were to declare road improvement an essential, the funds would be forthcoming without restriction.** This means one thing, and one thing only: Funds are denied for road improvement purposes, not because there are not funds enough, but merely because road improvement has been declared non-essential, and therefore is restricted financially. Note the distinction in this banker's explanation.

Workers in the construction field can depend upon it that if they don't come to the front in their own behalf they will continue to wear the non-essential label. From the other fellow's standpoint your business is generally regarded as a non-essential, if not an incubus. If he argues that your work is unimportant and you say nothing in defense of it, his point will be sustained. Only a few industries, like farming and coal mining, are essential beyond dispute; only a few businesses, like baseball, are clearly non-essential. All other businesses fall somewhere between these extremes. They will be classed as essential or non-essential, depending very largely upon the persistency and skill with which their just claims to the right of existence are presented.

It is probably unnecessary to argue that dependable highways are essential in war times, so far as our readers are concerned. If any reader who has successfully "reduced the art of self-abnegation to a science," and is unhappy unless renouncing his personal and constitutional rights, has any lingering doubt on this point, let him read the letter to the editor from Fourth Assistant Postmaster General Blakslee, published in the Motor Truck section of this issue.

But the question is not one of individual interest, but of individual duty. For months this journal has been urging its readers to use their influence to prevent our national leaders continuing their mistaken attitude on the highway question. We have asserted in every issue for months that official Washington fails to appreciate the economic importance of good, usable highways, and have, at the risk of being considered unpatriotic, urged our readers to exert all their influence to change the official opinion that such highways are now among the non-essentials.

These days the newspapers are carrying glowing prophecies of what this nation can do with the 25,000,000 tons of merchant shipping it will have available for commerce at the end of the war. We will have the ships, don't doubt it, and we will have cargoes, but it is going to be an economic impossibility to bring the cargoes to the ships unless our roads are made passable twelve months in the year instead of three.

Next to winning the war the thing the American people most desire is to see the cost of living reduced. The improvement of roads, making possible the hauling of mailable merchandise in motor trucks over the highways, in all seasons, will greatly reduce the cost of living. This consideration may yet so affect the national morale as to be the deciding factor in the war itself. Judged by military, social and economic standards, good roads are essential.

Force Account Work on Illinois Roads

The Division of Highways of the Illinois Department of Public Works and Buildings now has under force account construction two pieces of road work in Iroquois county, one in Kankakee county and two on the Lincoln Highway, one of the latter being at Chicago Heights and one near Malta. The Division of Highways very wisely decided to do this work by force account because the contractors' bids received were considered too high. When the contractors bid on these jobs some weeks ago they naturally made an allowance in their bids for the risk due to car and labor shortage, and other uncertain conditions due to the war. Consequently, it was decided to do the work by force account, the state thereby taking all the risk due to war conditions.

Construction of Water and Sewerage Systems for the Cities of Salto, Paysandu and Mercedes, Republic of Uruguay, South America

Municipal Improvements Costing $5,000,000—Plans Revised by American Engineers and Works Constructed by American Contractors Using American Materials and Methods.

By G. E. Hines, Chief Mechanical Engineer, Ulen Contracting Co., Chicago

It may surprise not a few of us to know that the Republic of Uruguay (La Republica Oriental del Uruguay) is a progressive, wide-awake republic, fully recognizing the advantages accruing from modern sanitary and municipal improvements. We should divorce from our minds the thought that this republic is infested with Indians, crocodiles, boa constrictors and revolutions. On the contrary, the country is inhabited by white people, highly civilized and intelligent, progressive, and differing only slightly from ourselves, and that chiefly in the language spoken.

Montevideo, the capital and largest city of the republic, with a population of about 400,000 people, is a modern city in every sense of the word, enjoying the benefits of a modern storm and sanitary sewerage system, water works, street railways, electric lights and gas. In municipal improvements, children's playgrounds, cleanliness, civic pride, and in the maintenance of law and order, it sets an example that many of our North American cities would do well to copy.

Geographically speaking, the Republic of Uruguay, in the Southern Hemisphere, lies between the same degrees of latitude as the State of Mississippi. The United States of Brazil forms its northern boundary, while the Atlantic ocean and its estuary, the River Plate, form the eastern and southern boundaries. The River Uruguay, which divides Uruguay from the Republic of Argentine, forms the western boundary, and as well supplies the full name of the republic, due to the fact that it lies entirely east of the river.

The distance from New York City by the shortest water route is some 7,500 miles and the time required by the passenger steamers is on an average about 21 days. The east coast of Uruguay is about 20 degrees east of New York City.

Political and Industrial Characteristics

The area of Uruguay is approximately 72,000 square miles, or slightly larger than the State of North Dakota. The population, as given by the 1908 census, was 1,042,186.

The Republic of Uruguay is divided into nineteen "departamentos" or states. The form of government is very similar to that of the United States of America. The President is elected for a period of six years, while the Governors of the various states are appointed by the President.

The country as a whole is not unlike that of parts of the United States. The land is a rolling plain, with very few trees, is well watered and particularly well adapted to the raising of live stock, which is the chief source of the country's wealth. Cattle and sheep thrive and fatten on the grass alone, no grain being required.

In addition to raising stock, certain sections are devoted to farming. The average annual production of wheat, amounting to approximately 9,000,000 bushels, as well as corn and alfalfa, contribute greatly to the country's wealth. The northern part of the republic is well adapted to citrus groves, while in the southern part are many vineyards.

One of the chief industries is the packing plants, chiefly owned by the various packing companies of the United States. There are several small factories for the manufacturing of shoes, harness, hats and other similar articles, but for the most part they depend upon importations. Fuel is very scarce.

The climate is very agreeable and healthful. The seasons are the reverse of those of the United States. The minimum temperature in the winter time is about 31 degrees F., while in the summer the maximum is about 90 degrees F. In the northern part it is much warmer in summer and not so cold in winter.

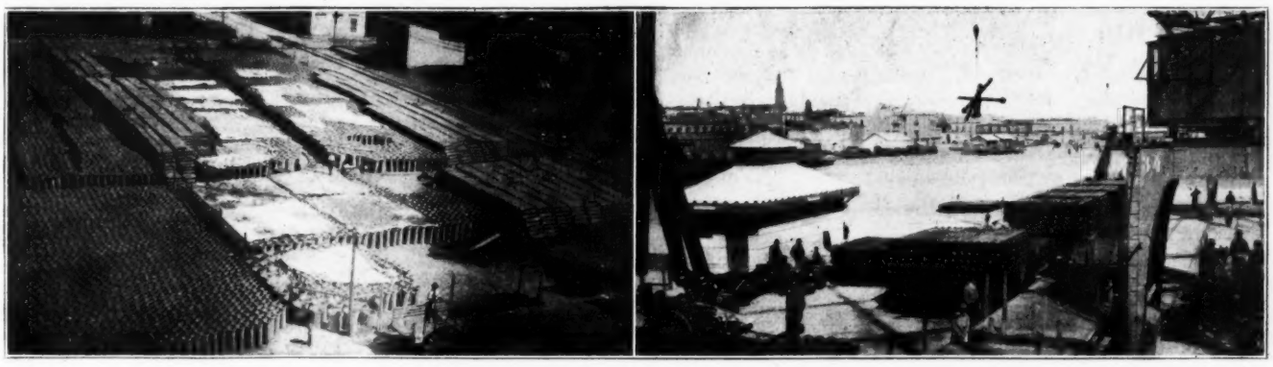
The language spoken is Spanish. The people are of a mixture of Spanish and Italian blood. The census of 1908 showed that about 18 per cent of the population were foreigners, of which about one-third were Italians, and the balance made up of Spaniards, Brazilians, Argentinians and other nationalities.

The monetary standard is the gold peso, worth $1.035 U. S. The total wealth of Uruguay is estimated at $2,000,000,000, of which $1,410,000,000 is invested in cattle raising or agriculture.

There are nine railway companies, operating a total of 1,630 miles of track in Uruguay, representing a capitalization on December 20, 1916, of $85,000,000. All the railroad companies are English.

History of the Work

By a special law enacted by the Republic of Uruguay it was decided to employ engineers to prepare plans, specifications, estimates and reports with reference to providing the cities



VIEWS ON WATER AND SEWERAGE WORKS BUILT IN URUGUAY BY AMERICAN CONTRACTORS.
Cement Pipe Made by Ulen Contracting Co., at Paysandu—Unloading Cast Iron Water Pipe From the "Edon" at Montevideo.

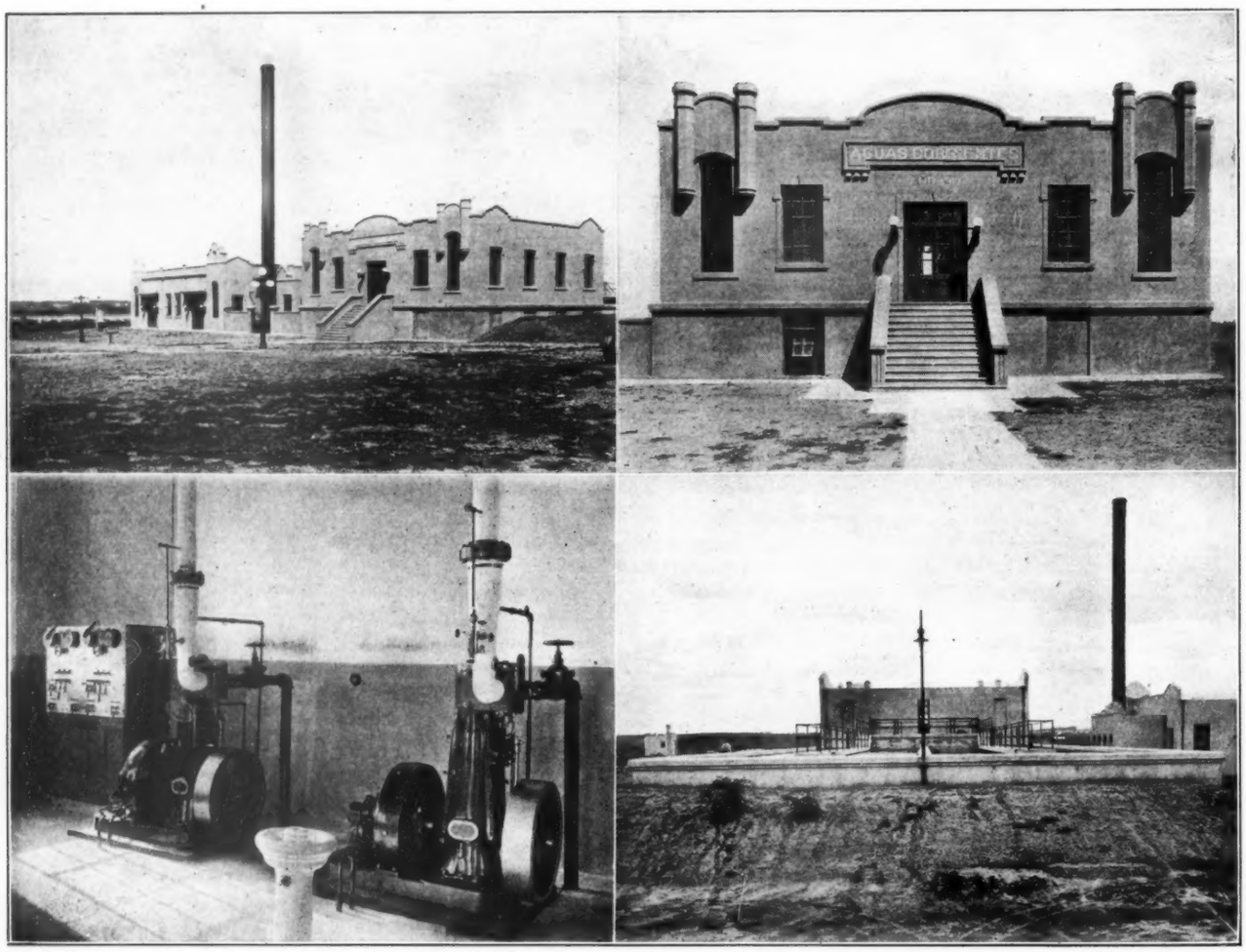
of Salto, Paysandu and Mercedes with water and sewers. A group of eminent French engineers were given a contract for this engineering work. Complete plans and specifications were prepared covering the principal cities in the republic. These plans were finished and approved by the Minister of Public Works in the year 1911.

A law was passed authorizing the President to enter into contract for the construction of the water and sewer systems as covered by the plans and specifications. Several tentative proposals by various contractors were made, but nothing definite was decided upon until 1915.

During the latter part of the year 1915 John R. Ulen, C. M. Bounell, vice presidents, and E. G. Trueheart, chief engineer, all of the Ulen Contracting Co., went to Uruguay and immediately took up with the Uruguayan officials the proposed works. A careful and thorough investigation of the company was made by the Uruguayan government, with the result that a contract was entered into on February 2, 1916, for building a complete water and sewer system for the cities of Salto, Paysandu and Mercedes.

By the terms of the contract the company agreed to take Uruguayan government bonds in payment, the work to be started within six months from the date of signing the contract and completed within three and one-half years. A clause, however, was inserted in the contract providing that if either the United States or the Republic of Uruguay should become involved in an international war or a civil war, the contract time was to be extended during the period of the war. A bond issue of 5,022,000 pesos, or $5,197,770 U. S., was authorized by the Uruguayan government for the work.

On March 27, 1916, the first contingent of the Ulen Contracting Company arrived in Montevideo. The work in Salto was started July 27, 1916, and was accepted by the government December 1, 1917. The work in Paysandu was started in October, 1916, and accepted in April, 1918, while the work in Mercedes was started in November, 1916, and accepted in January, 1918. From the time the first work was started until the last job was finished and accepted it required just half the time allowed for completion by the contract. This work was carried on after the United States of America entered the war and the company did not exercise its prerogative to stop work, as set forth in the contract, but continued the work even though prices of material and freight rates increased in some instances over 200 per cent.



VIEWS OF WATER WORKS DESIGNED AND BUILT BY AMERICANS, USING AMERICAN MACHINERY AND MATERIALS, IN URUGUAY, SOUTH AMERICA.

Top Row: Filter Building and Power House. Front View of Filter Building. Bottom Row: Lighting Sets for Lighting Buildings and Grounds. Settling Basins.

This attitude of continuing the work and finishing it during the war saved the Uruguayan government much money, and also increased the popularity of the Ulen Contracting Company with the Uruguayan officials.

Scope of the Work

According to the specifications, the population of the three cities in 1908 which were to be served with water and sewers was as follows: Salto, 23,000; Paysandu, 21,000; Mercedes, 15,700.

The water distribution systems, including the storage res-

ervoirs and discharge and equalizing mains, were designed for double the above populations. The sewers were likewise designed on the same basis.

The pumping plants and water purification systems were designed for the population as given, but the pumping period was 12 hours instead of 24 hours, so that by operating the plant 24 hours double the population could be served. All pumping plant equipment was in duplicate, so that loss of time due to breakage and shutdowns was reduced to a minimum.

The sewer system was the combined plan, designed to take care of the storm water as well as the sewage from houses, etc. The only city requiring, in the estimation of the government engineer, a sewage purification plant was Mercedes.

The source of water supply for Salto and Paysandu was the Uruguay river. Mercedes receives its water from the Negro river. These same rivers served also as the disposal point for the sewage. The water intake in every case was located from 2 to 3 miles above the point of the discharge from the outfall sewer. All pipe in the water distribution system was cast iron, while the sewer pipe was to be either vitrified clay or cement.

The water consumption per inhabitant per day of 24 hours was fixed at 150 liters, or about 40 gals. Ample allowance in addition to this was made for flush tanks and other uses. On this basis the daily water consumption for Salto was estimated at 2,221,000 gals. and for Paysandu and Mercedes 2,113,500 gals. each.

The water storage reservoirs for Salto and Paysandu were two reinforced concrete tanks on reinforced concrete towers, while for Mercedes, which was favored by a hill at the edge of the city, a plain concrete, rectangular reservoir, divided into two parts, was specified.

The capacities of the storage reservoirs were as follows: Salto, 581,000 gals.; Paysandu, 515,000 gals.; Mercedes, 1,016,000 gals.

The type of water purification plant specified was a combination of the slow sand and rapid sand type filters. Large settling basins were provided and so arranged that the water could be dosed with chemicals. The water passed over a series of aerating cascades from the settling basins to the prefilters. These prefilters were very similar to the rapid sand type, excepting that the rate of filtration was much higher than the standard adopted by the engineers of the United States. After passing through the prefilters the water flowed through a flume to the slow sand filters and thence to the clear water reservoir. The loss in head, i. e., the difference between maximum water levels in the settling basins and clear water reservoir, was 20 ft. 8 ins.

The type of pumping machinery specified was belted centrifugal, low-service pumps, and belted triplex, high-service pumps, all driven from a jackshaft. The prime movers were to be vertical, compound belted steam engines. The boilers were to be of the multitubular return tube type, each provided with a feed-water heater, to be located in the gas passages, similar to fuel economizers.

The total pumping heads, including low-service pumps and friction, were as follows: Salto, 250 ft.; Paysandu, 260 ft.; Mercedes, 255 ft.

The size of the discharge mains from the power house to the storage reservoirs was 20 ins. for Salto and Paysandu and 18 ins. for Mercedes. Between the two storage reservoirs for Salto and Paysandu there was a 24-in. equalizing main specified, in addition to a 24-in. line from each tank, which fed the distribution system. There was only one 20-in. line feeding the distribution system at Mercedes.

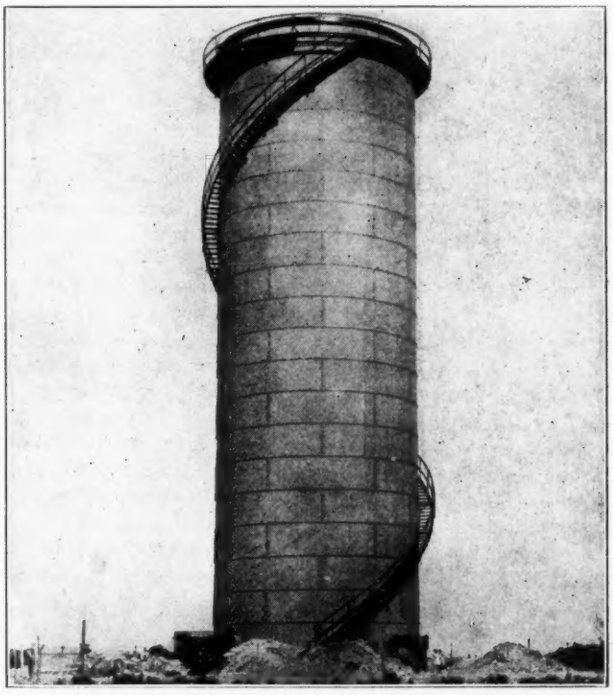
Owing to the difference in grades in the three cities, the size of the outfall sewers varied. The types of outfall sewers specified for all three cities were egg-shaped and the sizes were as follows: Salto, 5 ft. 5 ins. by 3 ft. 7 ins.; Paysandu, 6 ft. 11 ins. by 4 ft. 7 ins.; Mercedes, 5 ft. 11 ins. by 4 ft.

There were three types of sewers specified. The pipe sewers varied in size from 7⅞ ins. to 21½ ins.; the circular monolithic varied in size from 23½ ins. to 3 ft. 3 ins., while the egg-shape varied in size from 4 ft. 5 ins. by 2 ft. 11 ins. to 6 ft. 11 ins. by 4 ft. 7 ins. All monolithic and egg-shaped sewers were to be built of plain concrete.

The sizes of the water mains varied from the 3-in. service lines to 24 ins. Ample provision for fire hydrants, public service hydrants, valves and blow-off valves were made in the distribution system.

Changes in Plans and Specifications

Inasmuch as the plans and specifications were drawn with a view of utilizing European-made materials and equipment and European methods of construction, it was deemed advisable to ask the Uruguayan government to approve plans such that North American materials and equipment and methods of construction could be utilized. Accordingly plans and specifications were prepared by the engineers of the Ulen Contracting Company and submitted to the government officials. These were all approved and the work built in accordance therewith.



VIEW OF THE LARGER OF TWO STANDPIPES AT PAYSANDU, URUGUAY.

The most vital changes were as follows:

(a) Substituting American-made cast iron pipe for European-made and changing the sizes from the metric system to the nearest size in inches.

(b) Replacing all 3-in. cast iron service lines with 4-in.

(c) Changing the reinforced concrete storage reservoirs on concrete towers to standard steel standpipes.

(d) In lieu of plastering the interior of monolithic and egg-shaped sewers, steel forms were used instead of wood forms.

(e) Instead of belt-driven equipment for the pumping plants, changed to direct driven units, such as steam turbine driven centrifugal low-service pumps and triple expansion direct acting high-service pumps.

(f) A complete change in the water purification system, utilizing the modern North American mechanical filters.

(g) Change in all buildings from corrugated iron on steel frame work to brick and reinforced concrete.

(h) Revision of the plans covering intake, utilizing an intake well with strainers, check and gate valves, instead of timber cribs.

(i) Redesign of sewer system at Mercedes, eliminating

sewage purification plant and carrying outfall farther dc and well out into the channel of the river.

(j) Substituting wherever possible reinforced concrete for plain concrete.

(k) No vitrified pipe is manufactured in South America, and owing to excessive transportation rates from U. S. points concrete pipe was adopted.

(l) Changing from European-made flush tank siphons to the American type, as well as changes in the type of manhole, flush tank and catchbasin castings.

With the changes as outlined above, the plants as built are purely American, as all material that entered into the construction of the plants was manufactured in the United States, with the exception of the cement, which was manufactured in Uruguay.

Transportation

One of the largest and most vital questions which presented itself was the transportation of materials from the United States to the job. Practically all of the shipping had been taken over by the Allied governments for war purposes, and freight rates were climbing at such an alarming rate that the company purchased the "Alice M. Colburn," a four-masted schooner.

The amount of material that it was necessary to ship from the United States was some 16,000 tons. Three other vessels were chartered, and in addition several hundred tons were shipped on other vessels plying between New York and Montevideo.

The sailing vessels required from 57 to 86 days to make the voyage from Savannah, Ga., to Montevideo. The "Alice M. Colburn" made two round trips, each trip requiring something like nine months. The average time required by the steamers from New York was about 25 days.

On her first voyage the "Alice M. Colburn" was taken up the Uruguay river and discharged at Paysandu. All other shipments were unloaded at the modern docks at Montevideo and were sent to the various jobs by railroad and river boats. All three cities were favorably located for either railroad or water transportation; however, by either route the tariff was sufficiently high as compared to transportation in the United States.

The total weight of all material used on the works was a little in excess of 100,000 tons, so that the transportation problem was one of the largest handled and at the same time one of the largest items of expense.

Construction

Each job was handled independently of the others, and a complete organization was built up in each city. Montevideo was selected for the general office, and all three jobs were directed from that office.

The heads of the various departments were men especially selected from the United States. The superintendent of construction on each job, as well as the men in charge of the office, the master mechanic, the resident engineer and several foremen were all American men who had been with the company for years. The men soon learned to "get by" with the Spanish language, and everything moved along like a well-oiled piece of machinery.

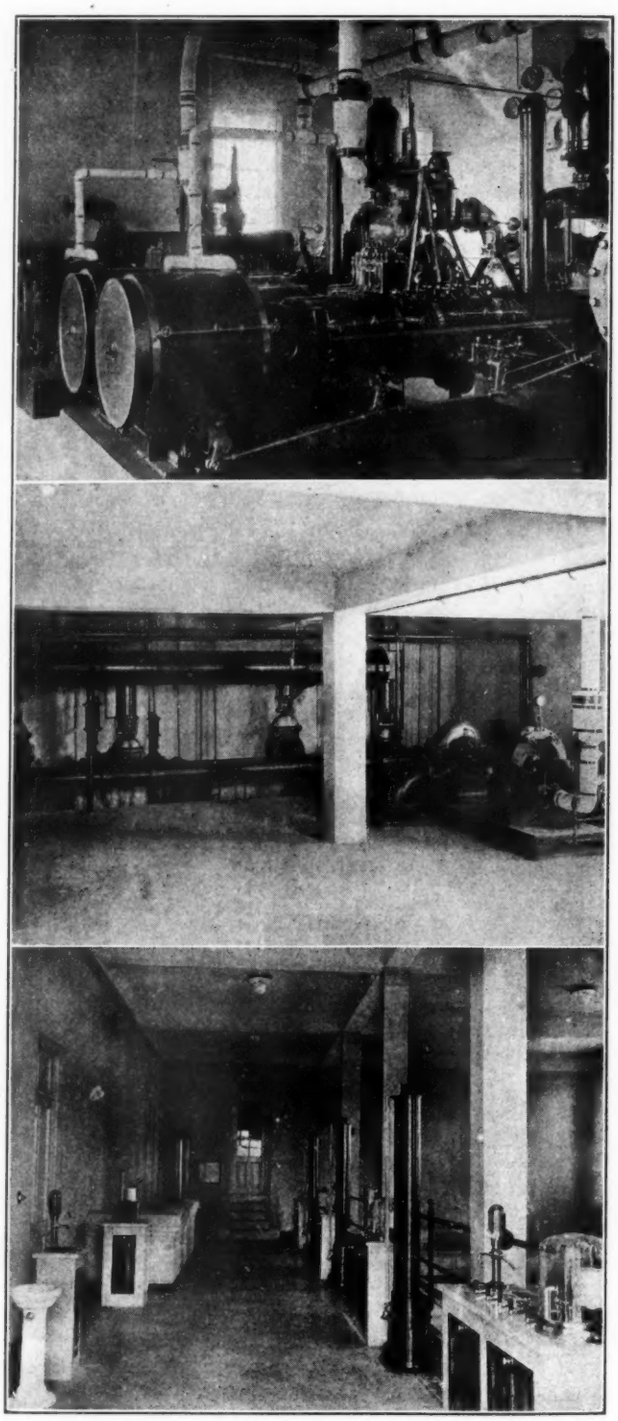
Cement Pipe Plant

One of the most important items of the entire construction plant was a cement sewer pipe machine made especially for the company. This machine caused more consternation and favorable comment on the part of the officials than any other piece of equipment on the job. The cement pipe plant was used first in making the pipe for Salto, then dismantled and moved to Paysandu, and then moved to Mercedes. More than 80 miles of cement pipe was made for all three cities in a little less than 8 months of actual working time.

The total length of all sewer lines, including house connections, main collectors and outfall sewers installed, was 133,403 ft. for Salto, 190,965 ft. for Paysandu and 145,223 ft. for Mercedes. The total number of barrels of cement used on all three jobs in the sewer system was 57,204.

Siphons

On the Salto job four double-pipe siphons were built for crossing several creeks within the city. The size of each pipe was 32-in. Class A, cast iron. At the entrance to each siphon was constructed a large sand or grit chamber and a settling tank. The part of the siphon which was submerged was imbedded in concrete, and on either side of the creek were con-



VIEWS OF PUMPING AND FILTERING EQUIPMENT OF WATER WORKS AT SALTO, URUGUAY.

View of High Service Pumps. Filter Pipe Gallery and Wash Water Pumps. Operating Gallery of Filter Plant.

structed large manholes, in which were located clean-out tees provided with a cover which could be readily removed and yet were water-tight. In each cover was provided a valve such that the sewage in the siphons above the clean-out tees could be drained down so that the manholes would not be flooded when the cover was removed. At the entrance to each siphon line there was also provided a sluice gate and the grit and settling chamber was divided into two parts, such that the sewage could be by-passed to either siphon pipe. There was one siphon in the Mercedes system similar to this.

The Sewerage Systems

Along the main collectors and outfall sewers on all three jobs were placed "vertederos," or storm-water overflows. These were so arranged that when the volume of the storm water reached the calculated carrying capacity of the sewer, the surplus would pass over weirs placed along the sewer main and would be diverted through a pipe directly to the river or other water channel. There were seven "vertederos" in the Salto sewer system, four in Paysandu and two in Mercedes.

The Mercedes outfall sewer was carried well out into the Negro river channel. At Paysandu the topography and other conditions were such that it was not necessary to prolong the sewer, so that there was constructed 3,346 ft. of paved open channel. The main outfall discharges into a sand chamber similar to that described for the siphons, and from there the sewage flows into the open channel. For the discharge from the "vertederos" at Salto it was necessary to construct 404 ft. of open channel work.

Flush Tanks and Manholes

On all three jobs four different sizes of flush tanks were constructed, varying in design only as to their capacity. The capacities were determined by the length and size of the lateral which was to be flushed. The capacities were 133 gals. for the smallest size to 532 gals. for the largest size. The other two sizes were 266 and 399 gals., respectively.

Two types of manholes were installed. Type No. 1 was installed over the pipe sewers and the smaller sizes of monolithic sewers, while type No. 2 was installed on the egg-shaped and large monolithic sewers.

The sewer system as designed by the European engineers was the zigzag system—that is, owing to the absence of alleys, the sewers are all laid in the center of the streets and follow as nearly as possible the contour lines. Therefore, at street intersections a manhole may have two sewers which will either pass over one another at different grades or will make a turn at different elevations, and in some instances the elevations are the same. For this reason it was necessary to use two different types of manholes.

All catchbasins were provided with 8-in. connections, which discharged directly into the manholes at the street intersections. The catchbasins were not provided with traps, as it was considered that in a semi-tropical country the odors from the matter contained in the traps would be more offensive than those emanating from the sewers proper.

Water Distribution Systems

The water distribution systems for all three cities consist of standard American-made cast iron pipe varying in size from 4-in. to 24-in. for Salto and Paysandu and from 4-in. to 20-in. in Mercedes. The pipe was all laid in the usual manner with bell and spigot joints. There are very few dead ends, as the system was laid out such that the entire district to be served is surrounded with the larger sized pipes. This district was then divided up into squares of about 16 to 20 blocks by smaller sized pipes, and the squares were then covered by ths 4-in. service pipes. Ample valves were provided for cutting off any desired section of the system.

The total length of the water lines laid in Salto, including the discharge main from the power house to the standpipes, as well as the equalizing lines between the standpipes, is 126,913 ft., while for Paysandu the length is 174,316 ft. As stated before, there is only one reservoir at Mercedes, and consequently no equalizing line, yet the total length of water pipe was 140,871 ft. On a tonnage basis there was more pipe laid in Salto than in Paysandu and more in Paysandu than in Mercedes. Paysandu required more pipe in length than either Salto or Mercedes, due to the fact that the city is less densely settled and covers much more territory than either of the other two cities.

VIEWS OF WATER AND SEWERAGE WORKS AT SALTO, URUGUAY, SOUTH AMERICA.
Stormwater Overflow Outlet—Stormwater Overflow From Sewer—Water Intake for Salto is at the Salto Chico Falls.

Hydrants

Fire hydrants of the flush type were installed at every street intersection in the business districts. In the residential districts they were spaced according to the density of population. In the outlying districts there were also installed so-called public service post hydrants. These hydrants are massive cast iron ornamental posts, each provided with a ¾-in. self-closing compression bib cock or faucet and a 2½-in. fire hose connection, and are for the use of the poorer classes, who cannot afford running water in their homes.

Over a half million pounds of lead was used in laying the pipes and setting valves and hydrants.

Water Storage

The water storage reservoirs for Salto consist of two steel standpipes, each 100 ft. high. They are provided with a spiral steel stairway on the outside, which leads to a balcony at the top. The standpipes are provided with a conical steel roof with a steel door.

The diameter of the larger Salto standpipe is 32 ft. 8 ins., while the smaller standpipe has a diameter of 30 ft. The total effective water storage is 1,152,000 gals. for the two standpipes.

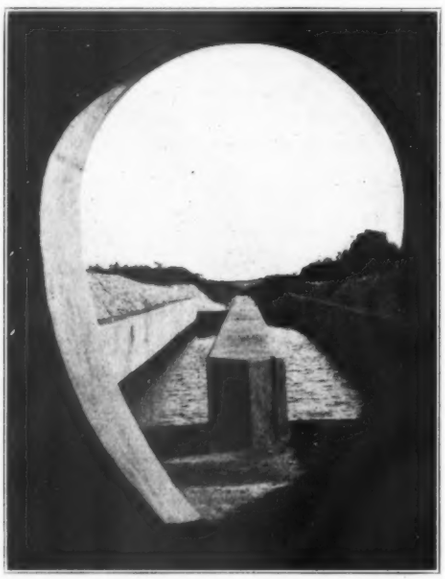
The standpipes for Paysandu are the same height as those at Salto. The larger is the same size as the large standpipe at Salto, while the diameter of the smaller one is 25 ft. The total combined available storage is 985,000 gals.

The storage reservoir at Mercedes was built, as originally planned, of concrete on top of a hill. The reservoir is rectangular in shape, with a division wall dividing it into two equal compartments and covered with a reinforced concrete roof,

supported on cast iron columns. The reservoir was buried two-thirds of its depth and the excavated material was used in banking around and covering it. The total water storage is 1,016,000 gals.

The water works intake for the low-service pumps consists of a rectangular concrete chamber 17 ft. 6 ins. deep. In this chamber is located an entrance gate valve, a twin trash strainer, check valve and by-pass valve, also a sump valve for emptying the chamber in case it is flooded. The chambers are waterproof, so that access can be had at all times to the contained apparatus, excepting, of course, during extremely high water.

All valves in the chamber are below minimum low water, while the suction line leading out into the river is totally submerged at all times. The water flows by gravity to the check valve within the chamber, and from there the pumps pick it up and discharge it to the mixing chambers of the settling basins. The intake chamber is covered and provided with a large steel door. All valves can be operated from the roof of the chamber, while it is only necessary to enter the chamber to clean out the trash strainer.



THE SEWAGE PASSES FROM SEWER THROUGH SETTLING TANK AND OPEN CHANNEL AT PAYSANDU TO RIVER BEYOND.

Water Purification Works

The settling basins, power houses, filters and filter buildings and clear-water wells, as constructed for all three cities, are the same size, as there was such a small difference in the capacities specified that it was more economical to make all three plants duplicates of each other than to alter the plans to fit the requirements. For instance, the capacity in gallons per minute was 1,540 for Salto and 1,470 for Paysandu and Mercedes. All three plants were built on the basis of the requirements for Salto, and thus by this change the government profited to the extent of increased surplus capacities for Paysandu and Mercedes.

The settling basins are constructed of reinforced concrete, divided into two parts, each half provided with a baffle wall. A mixing chamber designed for a 30-minute mixing period is a part of the basins. The basins, including the mixing chambers, are designed for a six-hour sedimentation period, and the results obtained with the river at various stages were absolutely satisfactory. During the ordinary stage of the Uruguay river and Negro river there is very little turbidity, while during the flood stages the rivers are not unlike the Missouri and Mississippi rivers.

The filter plant was built adjacent to the settling basins, one wall of the settling basins serving as a common wall for the filter plant. There are four filter units, each unit having an area of 195 sq. ft. The beds were constructed of reinforced concrete in the usual manner.

The building housing the filters, in plan 50 ft. by 55 ft., is constructed of brick, plastered inside and out. The roof is of reinforced concrete, supported on concrete columns. The filters, operating room, office, laboratory and chemical room occupy the first floor, while the pipe gallery and chemical storage constitutes the basement. Beneath the pipe gallery is a supplementary clear-water flume having a capacity of 26,000 gals., from which the wash-water pump receives its supply for washing the filters. This flume is connected to the clear-water well by means of a 20-in. cast iron pipe.

Filter Equipment

The filter equipment is the most modern obtainable. The operating tables are of marble, all valves hydraulically operated, automatic proportional chemical feed, the Earl improved type rate controllers, with master control, sample pumps and clear-water well depth gage.

The clear-water wells are built of reinforced concrete, with a reinforced concrete roof. The diameter of each is 50 ft., by 19 ft. deep. The roof projects about 18 ins. above the surface of the ground in each case, and is provided with a large steel door. Each clear-water well is provided with an overflow, the outer end of which is provided with a tide flap valve contained in a concrete box. The available water storage capacity of each clear-water well is 210,000 gals.

Power House

The power house, in plan 67 ft. by 52 ft., with a coal bunker 29 ft. by 12 ft., is the same type of construction as the filter house. In addition to the coal bunkers, the power house is divided into a boiler room, pump room, machine shop and bath room. In one corner of the pump room is a circular concrete pump pit 20 ft. in diameter, provided with a circular steel stairway. The depth of the pump pit for Salto was 25 ft., for Paysandu 14 ft. 6 ins. and for Mercedes 19 ft., these depths being controlled by the topography and flood stages of the river. The maximum low-service pump suction lifts are exactly the same for all three plants, while the length of the suction lines varies in accordance with the plant's location relative to the river.

THE URUGUAYAN LABORER.
Hot Weather (January) Costume—What a Gaucho Laborer Wears.

Power Plant Machinery

The power plant machinery for each city is in duplicate or divided into two groups, and consists of two 150-h.p. high-pressure, return tubular boilers, set in a steel casing. Each bat-

tery of boilers is provided with a horizontal steel breeching connected to a steel stack 4 ft. in diameter by 80 ft. in height. In each plant there is a 300-h.p. open-exhaust boiler feed-water heater and two 5¼x3½x5 boiler feed pumps. The high-service pumps consist of two horizontal, triple-expansion, direct-acting, condensing, pumping engines, while the low-service pumps are the split-case double-suction centrifugal type, directly connected through herringbone reducing gears to condensing steam turbines. The high-service and low-service pumps exhaust into 300-sq.ft. surface condensers, each provided with a direct-acting combined air and circulating pump. In each power house, for lighting the buildings and grounds, are two 8-k.w., 125-volt, direct-current generators, each directly connected to a vertical single cylinder steam engine.

All live steam piping was installed with long radius pipe bends, and properly covered. The exhaust lines were so installed that any piece of machinery in either group could operate with any other piece of machinery in the other group exhausting into either condenser. The condensate and trap discharges were returned to the heater through a common return line.

For each plant there was installed a machine shop, consisting of lathe, drill press, emery grinder, forge and anvil and the necessary bench tools, including pipe threading and cutting machines. There was also furnished for each plant a 22-in. gage industrial railway, with turntable, and a 40-cu.ft. coal charging car.

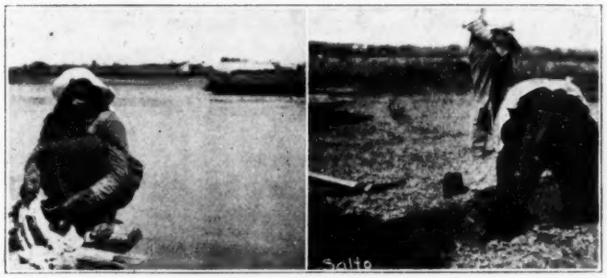
The Plant Buildings

Special attention was given to the exterior and interior finish of the buildings. All buildings were plastered and present the appearance of smoothly finished concrete buildings. The exteriors were plastered with a cement mortar containing a special coloring matter, so that they appear to be built with a buff-colored concrete. The interiors were painted the most desirable colors and the walls and ceilings of the filter house are hand frescoed.

Curb and gutter and paved driveways connect all buildings with the main driveway from the city. The buildings are all connected with an ornamental concrete tile sidewalk. In front of each power house there is an ornamental fountain and ornamental cast iron lighting standards to light the grounds. Special care was taken in grading up the grounds and around the settling basins. The appearance of the plants as a whole is in keeping with the artistic requirements of the Latin-Americans, for which they are justly famed.

Organization and Personnel

The Ulen Contracting Company, in March, 1916, after securing the contract, sold to the American International Corporation $4,000,000 of the Uruguayan bonds issued in payment for the work. At the same time Stone & Webster, engineers, became financially interested in the work and were represented in Uruguay by Mr. T. A. Devaney, chief accountant, and Mr. A. A. Northrop, progress engineer. The entire work was engineered and constructed by the Ulen Contracting Company, and about fifty of their men from their North American organization were sent to Uruguay. Mr. T. S. Shepperd, vice president of the company and general manager of the Montevideo office, was in immediate charge of the work. The company maintains offices at 120 Broadway, New York; 38 South Dearborn street, Chicago, and 1467 Ituzaingo, Montevideo.



JUST BY WAY OF LOCAL COLOR.
The Riverside Laundry, Illustrating Why Steam Laundries Do Not Pay in Uruguay—A Peon Would Not Feel Dressed Up Without His Knife.

PAVEMENT DESIGN AND CONSTRUCTION

Policy and Procedure of U. S. Highways Council During the War

Effective September 10, 1918

The United States Highways Council, J. E. Pennybacker, secretary, Willard Building, Washington, D. C., makes the following announcement with reference to policy and procedure as to highway and street work during the period of the war:

Approval Required

1. All proposed highway, street, culvert and bridge construction, reconstruction and maintenance involving (a) the issuance of bonds, (b) the use of rail or water transportation, (c) the use of coal or oil as fuel, or (d) the use of cement, brick, asphalt, oil, tar, crushed stone or steel (also sand and gravel where shortage exists), as highway material, should first be submitted for approval to the United States Highways Council through the appropriate state highway department. Forms have been prepared for this purpose and a supply placed with each state highway department. No manufacturer will furnish any road-building material until the project has been approved by the United States Highways Council.

Approval Confined to Essential Roads and Streets

2. The council again urges that new highway and street construction be confined to the most essential needs. If this is done there will be a far greater probability that the work thus selected can be promptly and effectively carried through to completion than if an amount far in excess of the available facilities were to be undertaken.

The council, in passing upon the projects which come before it, will give first consideration to maintenance with a view to conserving all the highways already completed, if possible.

Reconstruction will be favorably considered by the council only where it is clearly established that maintenance is no longer possible except at prohibitive cost.

Relative Merit of New Construction Projects

New construction will be given consideration by the council in the following relative order of importance:

(1) Highways and streets of military value;
(2) Highways and streets of national economic value;
(3) Unfinished contracts involving contractural obligations (incurred prior to April 5, 1918, where bond issue is in-

volved) which may not be disturbed without serious consequences;

(4) Streets and highways which, although not of national economic importance, are of such extreme local importance if the construction of which has progressed to such a point as to cause serious hardship if their construction or completion is postponed.

Council Hopes to Aid Approved Projects

The council is hopeful that the selective consideration of new highway and street construction by the township, county and municipal officials and in turn by the state highway departments will so materially eliminate the less essential projects as to make it possible for the council to render active aid on the projects it approved. The aid contemplated will be in the form of such action by the other government agencies involved as will remove obstacles to the speedy completion of the projects.

Definition of Highways of Military and National Economic Value

3. By way of definition of highways of military and national economic value the council offers the following:

(a) A highway of military value is one used regularly for the transportation of military supplies in considerable quantity; for the movement, as an established practice, of army truck trains, or which is essential to the efficient operation of a military cantonment, post or plant.

(b) A highway of national economic value is one which serves or will serve, if properly improved, directly to promote the welfare of the nation and not merely the local welfare. As examples it may be stated that in this class would be placed (1) highways which, although not directly used for military purposes, yet serve to help win the war by greatly facilitating the output or movement of war munitions and supplies; (2) highways which can clearly be shown to relieve congestion on railroad lines in a territory which is actually in need of such relief; (3) highways which give access to or promote the output of natural products needed by the nation to a marked degree; (4) highways which further housing operations undertaken by the federal government or by other agencies, with the approval of the federal government, would justify at times this designation.

State Highway Departments Requested to Disapprove Freely

4. State highway departments are requested to give most careful consideration to each application on its merits in the light of the policy announced by the council, and to exercise the power of disapproval freely. Only the projects approved by the state highway department will be considered by the council unless the department itself is in doubt and wishes a decision in the nature of a precedent.

Council Will Soon Begin to Formulate 1919 Program

5. The council will shortly begin, in co-operation with the Office of Public Roads of the Department of Agriculture, and the state highway departments of the several states, the preparation of a program of road and street construction, reconstruction and maintenance throughout the United States for the working season of 1919. The purpose of the program is to obtain an approximation of the character and amount of street and highway work deemed essential in 1919, together with an approximation of the amount and character of financing required, the amount and character of the various materials entering into the work, the extent to which rail and water transportation will be involved, and the probable demands upon the labor supply. The preparation of the program in each state will be directed by the state highway department, and will cover all state, county, township and municipal highway and street work.

Forms Are Provided

6. For the information of the state highway departments as to procedure forms are provided.

Form H. C.-3: Application to United States Highways Council for approval of project. This form should be filled out and signed by the public officials who are seeking approval of the project, and should then be filed with the state highway department. If the state highway department approves the application, it enters appropriate recommendation and certification on the last sheet of the form and transmits the application in duplicate to the United States Highways Council. The application is then given a serial number and its receipt acknowledged. It is then considered by the council and appropriate references made to the respective government agencies interested. The applicant and the state highway department are duly advised as to action taken. Forms F. 1 and F. 2 comprise application for approval of delivery of bituminous materials and certification of the application by the state highway department. These forms have been superseded by Form H. C.-3, but may be used if so desired where only bituminous materials are required.

Form H. C.-4: Schedule for use in submiting program of proposed highway and street work during the working season of 1919. This schedule is to be made up in four groups, namely, (1) state, (2) counties, (3) towns, townships or districts, and (4) municipalities. For each of these groups three schedules, respectively, construction, reconstruction and maintenance, are to be submitted. Definitions of construction, reconstruction and maintenance, respectively, are given on Form H. C.-4.

Announcement of June 20, 1918: A brief summary giving organization and purposes of the United States Highways Council, and showing the relation of various organizations represented on the council to highway work.

Circular No. C. S. 13, United States Railroad Administration: Rules promulgated to govern car supply for stone, sand and gravel, showing conditions under which open-top cars may be supplied by railroads and providing for application to the director of the Bureau of Public Roads, United States Department of Agriculture, where local car supply is insufficient. The representatives of the organizations mentioned in paragraph 5 of this circular comprise the United States Highways Council.

Applications Should Be Signed by Officials in Charge Rather than by Contractors

The council emphasizes the desirability of having the applications, which are made to the council for approval, signed by the officials in charge of the work rather than by contractors, as it is earnestly desired by the council that the state, county, township and municipal officials responsible for highway and street work shall actively assume responsibility in dealing with the difficult highway problems incident to the war situation.

The council will readily give its attention to any suggestions as to points which should further be brought out in making the policy and procedure of the council more clearly understood by the public.

Present Need of Correct Interpretation of Pavement Behavior Under Constantly Increasing Traffic Requirements

By Maurice B. Greenough, Assistant Secretary, National Paving Brick Manufacturers' Association, Cleveland, Ohio

The public is entitled to receive thoughtful and correct interpretation of pavement behavior from its engineers and officials. Growing use of highways for industrial, commercial and agricultural transport has imposed burdens upon some pavements that were beyond their capacity to bear. Imperfections have been made apparent that, to the eye of the layman, provoke hasty and not infrequently wholly incorrect conclusions. In the main, these conclusions have two effects, both disastrous: the public may lose faith in its engineers.

and in the minds of people generally may be fostered a check to highway transportation that the country can ill-afford to suffer.

Two Groups of Improved Roads

In the first place, the public needs to have impressed upon its mind that there are distinctions to the term "improved roads"; that surfaces employed lie in two groups, the one embracing macadam and its modifications or amplifications, and the various bituminous concretes; the other, the strictly hard surfaced pavements of which brick is one. Road improvements of the first group depend for their continued integrity after construction upon ceaseless and unremitting maintenance and repair, if at any time, previous energy and money expended are not to be irrecoverably lost. It is this class that comprises 98% of the country's improved road mileage. . The remaining 2%, only, is paved with inherently wear-resisting materials, which, like brick, require little or no maintenance and repair *provided type was correctly chosen and the details of construction correctly carried out.*

VIEWS OF TYPICAL, MODERN BRICK HIGHWAYS.
Left: View of the Geneva and Ashtabula, Ohio, Road. A Broad, Durable Track. Right: View on the Brook Park, Ohio, Road Between State and Berea Roads.

Many Roads Foredoomed to Failure

Precedent and lack of discriminating judgment have been responsible for locating many miles of Group 1 pavements where, even in pre-war times, traffic could be certainly expected in excess of capacity. Uneconomical and wasteful in those days, the evidence of the past year or two have simply reinforced the degree of waste. The public needs to be reminded that all road improvement is not wasteful merely because a meritorious type of improvement was misplaced; that there are types of improvement that could have served the same traffic without a blemish. Unreasoning pursuance of the doctrine of initial cheapness, while having an insinuating appeal to the superficial mind, has reacted many times against its devotees.

Duty and Opportunity of Highway Engineers

When pavements that should bear any degree of traffic without developing flaws do show imperfection, the layman frequently jumps to the conclusion that there is no hope whatever in road improvement, or that the particular pavement was not the correct type of its kind. In this connection, a concrete base is often held to be the solution—a sort of panacea of all ills to which pavements are heir. Others declare with equal vehemence that drainage of the subgrade provided artificially would have been the preventive. And yet we know that pavements have shown faults that were built upon concrete bases or that were artificially drained. It is the duty and opportunity of engineers to foster the truth about these things in the public mind.

Types of Brick Pavements

Let brick pavements serve to illustrate the point. There are many types or ways which the individually durable unit may be incorporated into a pavement. The brick itself is inherently wear resisting. Skill in designing brick pavements is exemplified by discrimination and economy in choosing the correct type. Thus brick pavements may be built upon natural soil, gravel, rolled stone or slag, worn-out macadam, or concrete bases. No one of these bases is of universal usefulness. The brick may be bedded in sand, a cement-sand mixture or directly in a green concrete base. Sand, bituminous or cement grout filler may be used in the joints. Brick may be laid on edge or flatwise.

Out of all these possibilities it is permitted to build pavements, affording the wear resistance of brick, to meet economically any degree of traffic and any reasonable amount of funds available. These are advantages that may be lost to the public in the hands of unthoughtful designers.

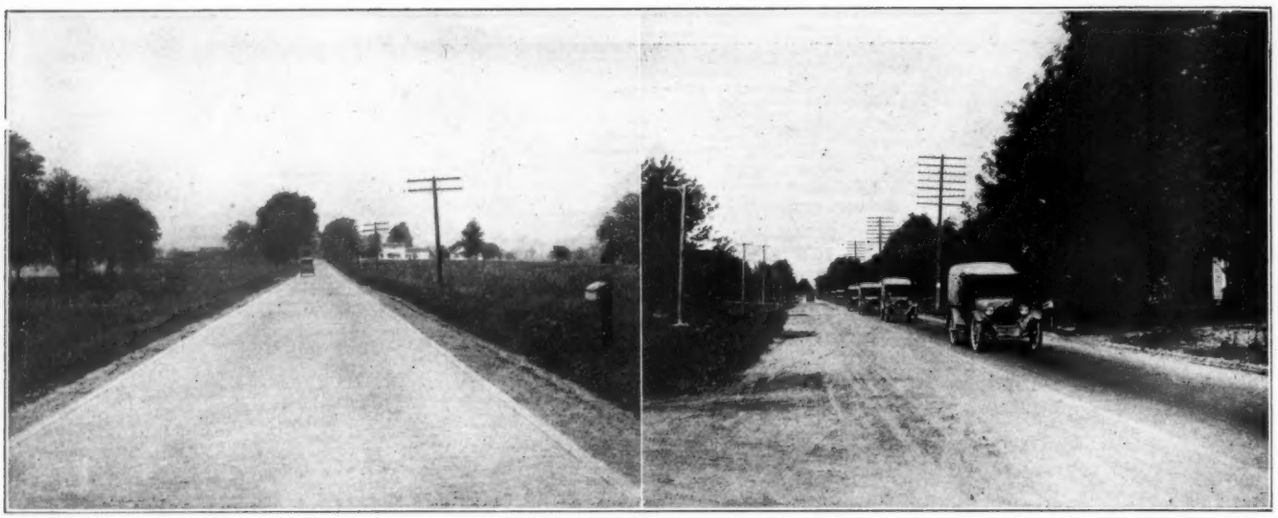
Details of Construction Are All-Important

Once a type is chosen, its details of construction ought to be executed with the best knowledge and intent known for that type. To revert to drainage: if subsoil drainage is required, it should be supplied; if the base is rolled stone, it should be prepared to the best of the builder's ability; if the base is concrete, the concrete should be thoroughly mixed, carefully laid and finished; and so on, each detail from subsoil to surface must be right. Given correct choice of type for the traffic, thorough workmanship and diligent supervision, traffic may use the pavement without further concern for its welfare. The same arguments apply equally well to pavements of any character, modified only by the inherent stabilities of the two general groups of surfaces mentioned.

Effect of Governmental Restrictions

Effects of governmental restriction on road improvement and maintenance are of course, now making themselves felt in making previous expenditures completely irrecoverable, so that, owing to the preponderating 98% of maintenance—requiring streets and roads, our highway improvements are wearing out faster than they are being replaced. This was even true in normal times; they are going faster since governmental restriction was imposed.

Virtues of Group 1 pavements to serve as foundations for Group 2 surfaces are being lost, and all the while are present the growing requirements of the country for highway transport—a growth that is in its infancy. Roads are imperatively needed for the farmers, merchants and manufacturers of the nation. Economic and military necessities know no qualification. Without adequate roads, the country is suffering loss of strength. Engineers and officials are in a position to point the way to the public generally and to other less well informed officials how to augment the nation's war strength. Improved roads are our greatest factor in consolidating economic resources, and the people of the country deserve to have highway problems and use of highway improvements placed before them in their true significance.



VIEWS ILLUSTRATING COMMERCIAL AND MILITARY ADVANTAGES OF PERMANENT TYPE OF HIGHWAY CONSTRUCTION.

Left: The Geneva and Ashtabula, Ohio, Brick Road. Food Raised Along This Road Is Doubly Valuable Through Potential Mobility. Right: The Center Ridge Brick Road in Cuyahoga County, Ohio. The Traffic Shown is Military but Food or Freight Can be Hauled Over the Road Equally Well Throughout the Year.

Work of the Highway Industries Association and Necessity for Closer Co-operation Between Federal, State and County Road Authorities

Address of H. G. Shirley, Secretary Highway Industries Association, at Annual Convention of North Carolina Good Roads Association

The Highway Industries Association was formed about the first of the year, it being realized by all manufacturers of road materials, machinery, etc., that it was very necessary to get together and form an association whose duties it would be to promote the interest of good roads and nothing else.

Officers

The association was organized in Chicago on January 21, and the following officers were elected:

President, S. M. Williams, Lima, Ohio; vice president, A. R. Hirst, Madison, Wis.; second vice president, E. J. Mehren, New York City; third vice president, S. T. Henry, Washington, D. C.; secretary, H. G. Shirley, 302 Maryland Bldg., Washington, D. C.

Aims and Objects

The aims and objects of the association are as follows:

To assist in co-ordinating the highways with the other transportation agencies of the country; to encourage the development of highways that will advance the economic life of the nation; stimulate their use in such a manner as to facilitate and cheapen the transportation of food, raw materials and finished products, and to co-operate with government agencies, both State and National, to the end that our highways may be of maximum service in the transportation system of the country.

Activities of the Association

The association has nothing to buy or to sell except the idea of good roads and the benefits derived therefrom. We have taken an active part in the road development question since our organization, first, by having highway transportation and improvement discussed at the annual meeting of the United States Chamber of Commerce at Chicago, and the preparation of certain resolutions calling for a federal highway policy and the centralization of authority.

We have assisted the state highway departments, the contractors and material people in trying to have the most radical advance in freight rates reduced to a conservative figure, and to have the contractors relieved from the operation of this order on those contracts let previous to the promulgation of the order.

We will assist any road organization or highway department in supplying literature and speakers in any campaign for better roads or for larger appropriations and in every way possible for the advancement of the good roads subject.

It is realized by all industries who manufacture material for the construction of roads and for the use thereof that it is to their interest, as well as to the general welfare of the country, that road construction should be put on a firm basis and that some effort should be made at least to keep pace with the demands and needs of the country in road building.

Why It Is Necessary to Speed Up Road Improvements

From the preliminary studies made it is shown that the rate of surfacing of roads, as heretofore carried on, has not kept up with the development of the country, there being actually opened up each year approximately 50,000 miles of road, while the total number that has been surfaced has not exceeded 15,000 miles per year. It is clearly shown that the

country is opening roads at least three times faster than surfacing is proceeding. When you consider that there already exist approximately 2,750,000 miles of roads, of which not over 300,000 miles have been improved, it will be clearly demonstrated that to improve the remaining 2,500,000 miles would require, at the rate we have been going, something like 166 2/3 years. Granting that the total mileage should not be improved and is not of sufficient recreational or commercial value to justify an expenditure for improved surface, it cannot be denied that at least 20 per cent of this total mileage should be undertaken as soon as possible.

It would require, at the rate that we have heretofore gone, 33 years to complete the 20 per cent, and by the end of the 33 years there would have been opened up 1,650,000 miles of new roads, giving a gross total of unimproved roads at the end of that period of 3,650,000 miles. This is based on the assumption that the number of miles opened annually will be the same throughout this period.

This we know is not true, for as the country becomes more closely settled, a greater number of miles of roads each year will be opened up, and I should say that at the end of 33 years there would be something like 4,000,000 miles to be improved.

To provide for the proper surfacing of the opened roads it will therefore be necessary for the states, counties and townships at least to double their appropriations for road improvement and for the national government to participate largely in the development and construction of a federal system of highways.

Federal, State, County and Township Road Systems

The time has arrived when there should be a federal system of roads, a state system of roads and county and township systems, and it is the object of the Highway Industries Association to co-operate with all these bodies to the end that this most beneficial result will be obtained.

It is necessary, however, that before we can expect any great improvement, closer relations and more earnest co-operation should be given by the federal government, state highway departments, the counties and townships to each other, and one of the most important agencies to which we shall have to look for the greatest amount of this work to be accomplished will be the state highway departments, and, therefore, I wish more particularly to call attention to the important functions of such a department and the great necessity for a hearty co-operation with them.

Importance of State Highway Departments

The highway departments of many states have become the most important single branch of the state government, and in many instances supervise an annual expenditure of more than the total amount expended by all the other departments of the state.

New Jersey, in the early nineties, established a state highway department, and was soon followed by Massachusetts and other states, until today we have a state highway department in every state. The authority of these 48 highway departments varies from an educational and advisory capacity to having full charge of all expenditures, plans, and the supervision of the work.

The time is here when it is necessary for the federal government to take over, build and maintain the trunk lines of this nation, both east and west and north and south; the state highway departments to take over, build and maintain the main state arteries leading into the federal system, and the counties and townships to take over those roads of local importance.

The relationship between these departments, or subdivisions, of our government is so close that one cannot do effective work without the active help and co-operation of the other.

The great importance of the state highway departments has been increasing with leaps and bounds, until today we see the state highway department the actual head of all road and street work in their respective states, for no city, town, county or township can proceed with any road work where the materials have to be transported by rail, until they have first secured the approval of their state highway department, for the United States Highways Council will not consider any requests for shipment of materials or other road supplies until first passed on and approved by the state highway departments.

The war has only emphasized the close and logical co-operation that is necessary between the state and federal government to secure the very best results, and the same co-operation must exist between the counties and townships and the highway departments to secure similar results.

Support the State Highway Departments

The state highway departments are institutions of the state government that have come to stay, and will grow into greater usefulness and importance as time goes on. Their usefulness may be delayed by petty jealousies, small politicians and sectional narrowness, but they are such important constructive units that they are bound to take a most active part in state and national road affairs.

Through political manipulations and sectional narrowness, I have known state highway departments to be legislated out of existence, or their appropriations and powers so restricted that they were practically useless, and while struggling under such handicaps and burdens, they were being attacked and criticised in the most vitriolic and scathing language; but from the embers of the destroyed structure, restricted laws or burdens, emerged a more permanent and more powerful state highway department.

It is a trite saying that "Man can retard progress but he can not stop it," and thank God he can not.

There are many who seem to think that it is their special mission in life to object to everything that goes to the promotion and advancement of the general welfare of the state, or changes the condition that existed 20 years ago. This species, unfortunately, is found in large numbers in every state, and especially in road matters. It is therefore the duty of every one who realizes the importance of roads to do everything they can to overcome this feeling. Nine men out of ten will agree with you that the more important roads of a state and neighborhood should be improved, but when you suggest to him that the proper way to secure this desired result would be by giving his state highway department greater authority and larger appropriations so that it could accomplish things, he will immediately tell you that the state can not afford to increase its taxes and that the roads will cost too much, when, in fact, the highest tax he is paying is that levied by the mud road on transportation and he, as well as every other citizen of the state, can not afford not to spend more money to get rid of this most expensive burden.

Co-operation Is Essential

It is, therefore, most essential that the counties and towns should co-operate with their state highway departments to the fullest extent, for without the proper co-operation and support, both morally and financially, the best results can not be secured.

The national government undoubtedly will undertake to assist in constructing the main trunk lines of the country, and we may rest assured that they will not deal with a smaller unit than a state, and for this reason it is most essential that each state clothe its highway department with proper powers and appropriations to meet all the requirements that may be placed on such road construction by the national government. If any state is so short-sighted as not to place its state highway department in a strong position, then she can not expect to receive the same benefits from the national government as her more fortunate sisters who have highway departments well equipped to undertake almost any work that the United States government may require, or to formulate plans of state systems to tie in with the national system, so

as to give the state the most advantage for the least expenditure.

I can not emphasize too forcefully the great necessity of formulating a plan and system of state and county highways, for the development and returns from such development that will take place in the state when such a system has been constructed will far exceed the cost of such a system, not considering the recreational and many other advantages that are derived therefrom.

The Highway Industries Association is purely a co-operative body, and therefore wishes to advise all road workers if it can be of any assistance it will be only too glad to be called upon. Our organization is for the promotion of the good roads idea; we have nothing to hide and everything is open and above-board. We realize that it is to the advantage of the highway industries to have roads improved, as well as to the general advancement and welfare of the country, and we feel that all our labor will have a two-fold benefit.

Distribution of Costs on Street Paving Construction

By Ray S. Blinn, Civil Engineer, Lock Box 308, Port Clinton, Ohio

There are a few simple rules that govern account classifications on street pavement construction.

First, where several jobs of like character are being handled at the same time, it is more important to determine the cost of the operation than the cost of the job.

For instance, should the contractor be constructing, say, five brick paving jobs at the same time under similar specifications, and where men are constantly being shifted to one street from another, or working on junctures, it is best to distribute the expenditures not by jobs, but under such headings as grading, curbing, draining, foundation, cushion, laying and filling. In other words, it is the cost of the operation which concerns the contractor rather than the cost of the job.

Second, all operations such as enumerated above can be primarily classified as labor, material and overhead.

Now, if as close a distribution as this is decided upon, it is well to make a list before opening the books as to just what items will come under each head. We have always classified man power, horse power and machinery power as labor. It is a fine question as to the propriety of charging coal, gasoline and depreciation of labor-saving machinery to the labor side of the column, but it seems to me that is proper.

Material embraces the cost of material at factory, the freight or any supplies that go to make a part of the job for which pay is received, and nothing else.

Overhead embraces such miscellaneous items as salaries, office expenses, trips, telegrams and so on, that become necessary for the carrying on of the general business.

Third, the time to classify is at the time the bank check is made. The proper form of check is the voucher check. Upon the front or back of the voucher stub should be the classification printed that is desired, and all books posted from these stubs. Even all such small cash expenditures as car fares, all emergency cash outlays, should be entered on a memorandum book and check issued to the disburser at the end of the week, or at least before the object of expenditure is forgotten and it is erroneously classified.

The above rules comprise my idea of cost distribution methods for small contractors on similar work, such as paving construction. At the present time, while paving work is at a low mark, is a good time to study cost accounting.

As outlined in a previous article, make the classification simple and large. It does not pay to impose any unnecessary tasks upon foreman or field men. It is hard to get them away from the usual name and time book. If you can, or rather where you can, try the individual card system. When they see how easy it is to let the card go with the man, and the elimination of argument with the men over shortages, the usual foreman will readily acquiesce.

For larger business there are cross-classifications between "Character of the Transaction" and "Object of Expenditures." Under the first are detailed personal service, contractual service, supplies, materials and gratuities. Under the second are operation, maintenance of equipment, refunds, etc. For extended systems beyond this look up the bibliography of the New York Bureau of Municipal Research, or the various departments at Washington. These have most exhaustive studies for the benefit of those who want to make a hobby of it.

Some Design and Construction Features of Concrete Roads

By A. N. Johnson, Consulting Highway Engineer, Portland Cement Association, 111 W. Washington St., Chicago

In the design of a road, there are two essential dimensions—width and thickness—which must be determined and which it is evident are the chief factors controlling the cost per unit of length. As it is always the endeavor to make this cost as little as possible, too many roads are made both too narrow and too thin.

Width of Pavement

As the thickness of the pavement is to a certain extent a function of the width, the width is the dimension to be first determined. Owing to the greatly increased weight of traffic and to the fact that a large proportion of the traffic on the main roads is self-propelled, it becomes necessary that the width of the paved portion of the road should be sufficient to make it unnecessary for any of the wheels of a vehicle to leave the pavement and run upon the soft side or shoulder. If the traffic is all in one direction, and not so numerous but that a single track will be sufficient to care for it, then the paved portion of the road need be no wider than is required for a single vehicle. This is a condition, however, that is never experienced practically, although it is approached on a number of roads. It frequently happens that at a given time of day nearly all the traffic is in a given direction, particularly the loaded vehicles, so that it is rare for two loaded vehicles to meet. If one vehicle must leave the paved portion of the road it will be the unloaded vehicle. These conditions, combined with the fact that there is so limited a mileage of improved roads in most sections of the country, together with the endeavor to build a road between certain points with half as much money as should be expended, has made it expedient, apparently, to construct many miles of single track roads.

Traffic Increase Follows Road Improvement

Experience has shown, however, that no sooner has a road been improved than the amount of traffic it carries is increased many fold. Scarcely a year passes before the community discovers that the road is too narow. If it were possible to handle such matters in the most efficient way, it is doubtful if there would be found public roads on which a single track construction could be justified. Where a single track road is constructed it is an utter waste of money to make it wider than is necessary for single track traffic, if such a width is not sufficient for two lines of vehicles. Ample experience has demonstrated that 9 or 10 ft. gives a width sufficient for a single line of motor vehicles to be operated with safety and comfort. Therefore, to construct a 12, 13 or 14 ft. width is merely to waste the extra 3, 4 or 5 ft. of pavement, as the case may be. As it is certain that it will be but a short time before the community discovers that the single track is insufficient, roads should be so built as to make it possible to widen to a two-track road at a minimum expense in the future. It should, therefore, be laid with one edge at the center of the right of way of the highway.

The majority of roads are now being paved for at least

two-track traffic. It should require no argument to convince anyone who has had any experience on roads of less width under our modern traffic conditions that 18 ft. is a minimum to allow for two-track traffic. Anyone possessed of the slightest vision should realize that on our main roads a less width is barely short of criminal. The next practical width should be one that would accommodate three lines of traffic. Such a width of road is called for where at a given time of day there is considerable traffic movement in one direction which is reversed at a later period of the day. A three-track road under such circumstances may be as serviceable as a four-track road. For each line of traffic to be accommodated, 9 ft. is a minimum width to allow. A better width, one that will prove to give greater safety and comfort, would be 10 ft. And the time is not far distant when we shall see hundreds of miles of roads constructed 30 and 40 ft. in width to accommodate intertown highway traffic.

Thickness of Pavement

The proper thickness for a pavement of any good type must at best be founded on empirical rules. It is a fact, as with many other features of highway design, we have no data on which to base sound conclusions as to the proper thickness. The increase in the weight of loads which are hauled, and will be hauled over our highways, makes it all the more necessary that an investigation should be made which will determine this very important factor.

The general practice in concrete road construction has been to place roads of 18 to 30 ft. in width with a thickness of 6 in., at the sides and from 8 to 9 in. at the center. There are many concrete roads built with a thickness of 5 in. at the sides and from 7 to 8 in. at the center.

Without more precise data it is idle to offer much theoretical discussion as to the proper thickness of a pavement. Practical judgment would indicate that in the face of the increasing weight of traffic, it would be folly to decrease the thickness. This has been demonstrated practically in the instance of certain roads built 4 to 4½ in. in thickness, which in a number of instances were broken by track traffic. If we may allow ourselves to theorize for a moment, let us suppose the 4-in. thickness was just at the breaking strength of the slab. Then if we are to use the usual factor of safety of 4 our slab should be 8 in. thick. Without more exact data at hand this illustration affords at least some basis for a recommendation that a concrete road slab should not be less than 8 in. thick at the sides if it is to support heavy truck traffic.

Tables I and II will be of help in making estimates for concrete roads of various widths and thicknesses. It is to be noted that the 9 and 10 ft. widths are given as half the quantities for 18 and 20 ft. width roads on the assumption that the narrower widths are laid at one side and are subsequently to be widened to full width.

Side Forms

More attention is now given to the placing of side forms than was formerly realized to be necessary. Experience has shown that a number of concrete roads otherwise well constructed have long undulations in the surface clearly attributable to the fact that the side forms had not been held true to grade, particularly where one section of the forms joined its neighbor. It is essential that the side forms shall be firmly supported so that if a heavy tamping template or a machine tamper is used it will not tend to sag the forms at the joints. An excellent way to insure proper support for side forms is first to drive stakes to a firm bearing, with their tops at such an elevation that when the side forms rest upon them their upper edge will be true to the grade of the road.

Where any considerable mileage is under way it is economical for a contractor to equip himself with metal forms. These are usually a channel shape with special devices for holding them firmly in place and at the same time make it possible to remove easily the pins or stakes which support them.

The modern finishing machines use the side forms as a track and furnish an added reason that they be placed firmly and accurately.

Equipment for Handling Materials

It was common practice on the earlier concrete roads to haul the materials to the work by teams. The subgrade being prepared, materials were dumped upon it ready for use in the mixer into which they were shoveled by hand. On most of the work it was customery to handle the materials by means of wheelbarrows which were used as measuring boxes. It is thus clear that the hauling and handling of materials to the mixer constituted a large portion of the expense of laying a concrete road, being from 30 to 35 per cent. of the total cost.

An opportunity was presented for a very considerable saving in handling these materials and special attention was given to this phase of the work as larger contracts were awarded and a much longer mileage constructed at one time. After a trial of a number of methods, including motor trucks and tractors with trailers, the most satisfactory and most economical method has been the industrial railroad which runs upon a narrow gauge, light track which is laid from the point the materials are received extending thence alongside the road to be constructed. It still remained the practice to dump the materials on the

TABLE I—AREAS OF CROSS SECTION, CUBIC YARDS PER LINEAR FOOT, AND SQUARE YARDS OF SURFACE FOR CONCRETE ROADS FOR VARIOUS WIDTHS AND THICKNESSES.

Width Ft.	Thickness Sides In.	Thickness Center In.	Average In.	Area of Cross section Sq. ft.	Cubic Yards per linear foot of pavement	Sq. yds. per mile
9	6	8	7.33	5.50	.204	5280
10	6	8	7.33	6.111	.227	5867
18	6	8	7.333	11.000	.407	10560
18	7	9	8.333	12.500	.463	10560
18	8	10	9.333	14.000	.519	10560
20	6	8	7.333	12.222	.453	11733
20	7	9	8.333	13.777	.510	11733
20	8	10	9.333	15.555	.576	11733
24	6	8	7.333	14.667	.543	14080
24	7	9	8.333	16.667	.617	14080
24	8	10	9.333	18.667	.691	14080
26	6	8½	7.667	16.611	.615	15253
26	7	9½	8.667	18.777	.695	15253
26	8	10½	9.667	20.944	.776	15253
27	6	9	8.000	18.000	.667	15840
27	8	11	10.000	22.500	.833	15840
30	6	9	8.000	20.000	.741	17600
30	8	11	10.000	25.000	.926	17600
36	6	9½	8.333	25.000	.926	21120
36	8	11½	10.333	31.000	1.148	21120
40	6	10	8.667	28.888	1.070	23467
40	8	12	10.667	35.555	1.317	23467

TABLE II—QUANTITIES OF MATERIALS REQUIRED PER LINEAR FOOT OF CONCRETE ROADS FOR WIDTHS AND THICKNESSES SHOWN.

Quantities based on 1 barrel cement, equal to 4 cu. ft. and that voids in stone average 45 per cent. Adapted from quantities as given by Taylor & Thompson for 1 cu. yd. concrete.

Cement 1:2:3 1.74 bbls. 1:1½:3 1.91 bbls. Sand 1:2:3 0.52 cu. yds. 1:1½:3 0.42 cu. yds. Stone 1:2:3 0.77 cu. yds. 1:1½:3 0.85 cu. yds.

Width Ft.	Thickness Inches Sides	Center	Cement Barrels 1:2:3	Cement Barrels 1:1½:3	Sand Cubic Yards 1:2:3	Sand Cubic Yards 1:1½:3	Rock or Pebbles Cubic Yards 1:2:3	Rock or Pebbles Cubic Yards 1:1½:3
9	6	8	.355	.389	.106	.086	.157	.173
10	6	8	.394	.433	.118	.095	.175	.193
18	6	8	.708	.777	.212	.171	.313	.346
18	7	9	.806	.884	.241	.194	.357	.394
18	8	10	.903	.991	.270	.218	.400	.441
20	6	8	.788	.865	.236	.190	.349	.385
20	7	9	.887	.974	.265	.214	.393	.434
20	8	10	1.002	1.100	.300	.242	.444	.490
24	6	8	.945	1.037	.282	.228	.418	.462
24	7	9	1.074	1.178	.321	.259	.475	.524
24	8	10	1.202	1.320	.359	.290	.532	.587
26	6	8½	1.070	1.175	.320	.258	.474	.523
26	7	9½	1.209	1.327	.361	.292	.535	.591
26	8	10½	1.350	1.482	.404	.326	.598	.660
27	6	9	1.161	1.274	.347	.280	.514	.567
27	8	11	1.449	1.591	.433	.350	.641	.708
30	6	9	1.289	1.415	.385	.311	.571	.630
30	8	11	1.611	1.769	.482	.389	.713	.787
36	6	9½	1.611	1.769	.482	.389	.713	.787
36	8	11½	1.998	2.193	.597	.482	.884	.976
40	6	10	1.862	2.044	.556	.449	.824	.910
40	8	12	2.292	2.515	.685	.553	1.014	1.119

roadbed and rehandle them into the mixer, but methods of handling materials so that it is unnecessary to store them upon the subgrade have now been developed. The small cars are so constructed that they may be readily removed by a light derrick attached to the mixer and the entire contents of a single car dumped directly into the hopper of the mixer. Each car carries the correct proportions of cement, sand and coarse aggregate.

By the proper track arrangement it is possible so to arrange a distribution of the cars and locomotive that the mixer always has a supply of material and the locomotive is not held for any length of time. This method is not only the most economical yet developed, but has a distinct advantage in that it is not necessary to put the materials upon the subgrade, which avoids getting some of the earth of the subgrade into the concrete, or the other alternative of wasting an appreciable amount of the aggregates. By this arrangement it is possible to haul materials for 10 to 12 miles at a cost that is no greater than for a two or three mile haul with teams.

The length of roads now placed under a single contract are large enough to warrant a contractor investing a very considerable amount for a complete outfit and giving very close study to his equipment layout. Engineers in planning work must be familiar with the most economical methods of handling materials and know at what rail points it will be most economical to receive the materials and the roads that will be necessary to have occupied temporarily with tracks. It is becoming more and more, and should be, a function of the engineer in charge of work not only to design it properly but to lay out the order of construction and know that it will be carried on not only in the most economical way, but with the least inconvenience to the public.

Placing Concrete

The necessity for care in placing concrete from the mixer onto the subgrade has come to be more fully appreciated as more experience has been gained. If it happens for any cause that a batch of concrete as deposited in the road tends to have portions of the aggregate segregated it is of importance that the concrete shall be re-distributed so that there shall be no segregation, particularly towards the surface. The drier the mixture the less tendency there is for this segregation, which furnishes an additional reason for care in the amount of water used in the mixer.

On some of the earlier roads the concrete was distributed by shovels and not sufficient care taken to insure a true surface. The use of a template to strike the concrete on the narrower roads remedied this to a great extent. On wider roads, those much over 24 ft. in width, it becomes very difficult for workmen to manipulate a template extending across the pavement; either the template, in order to be sufficiently stiff, is too heavy to handle, or if light enough to handle is not sufficiently stiff to hold its shape and therefore its purpose defeated. It is the best practice to have two templates, the first one being considerably heavier than the second one.

Much of the unevenness resulting from inattention or inability to secure a true surface is remedied by the use of a roller. The roller, which is operated transversely to the direction of travel upon the road, has the tendency to smooth out waves in the surface of the concrete which have their axes in a transverse direction, and if waves remain after the use of the roller their axes are longitudinal and, therefore, cause no discomfort or inconvenience to traffic.

Reinforcement of Concrete Roads

The precise function or, perhaps more accurately, the manner in which reinforcement affects the service rendered by concrete roads is by no means clear. Certainly there has been advanced no satisfactory basis on which to make recommendations as to the proper method of reinforcing a concrete road.

As a result of careful observation of something over 30 million sq. yds of concrete roads, some of which were reinforced and some were not, the conclusion is reached that the reinforcement that has been used, generally averaging about 28 lbs. of metal per 100 sq. ft. of pavement, has not lessened the number of cracks, but has had a marked influence on the width of the cracks that have formed. That is, in the non-reinforced roads a far larger proportion of the cracks have opened sufficiently to become noticeable and require filling with tar or asphalt for proper maintenance. On the reinforced roads a majority of the cracks have not opened up sufficient to be casually noticeable and have not required any filling.

The cracks which occur are usually transverse or longitudinal. Most transverse cracks are occasioned because of the shrinkage in the concrete due to setting. In this connection it is interesting to note a difference in the number of transverse cracks that occur in concrete roads laid in warm weather and those laid in the fall, the former having a larger number of cracks.

It is evident that these transverse cracks cannot become very much widened by movement of the concrete slab and if given prompt and proper attention do, as a matter of fact, cause very little or no inconvenience whatever.

Longitudinal cracks are occasioned primarily by unequal movement of the foundation. In general, the cause of this movement is due to variation in the moisture content of the subgrade which may occasion either a slight rise or a slight depression. When a longitudinal crack occurs there is opportunity for it to widen as the two portions of the slab tend to separate; so that transverse reinforcement which will tend to hold the two sections of the slab together, although not sufficient to prevent cracking, performs a function of definite value.

As the object to be attained by reinforcement is chiefly to hold portions of the concrete together where a crack has occurred, particularly to hold the edges of the crack together at the surface, the reinforcement should be placed nearer the top surface than the bottom of the slab. If the slab cracks because of tension in the surface then the upper edge of the crack or portion exposed to the surface tends to widen and reinforcement at this point would help hold it together. If a crack occurs because of tension in the lower side of the slab, it will not open up at the surface, therefore no particular harm has resulted, and the reinforcement being in the upper section of the slab will keep it from opening further. It has thus become a general practice to place the reinforcement near the top of the slab, about 2 in. from the surface.

More exact data are necessary before any definite conclusion can be drawn as to the actual economy of reinforcement. Until such are available, it is probable that the use of reinforcement will, to a great extent, depend upon its cost. A good, practical rule to follow in the meantime would be to reinforce those portions of the road where the drainage conditions lead the engineer to expect the greatest disturbance to occur in the subgrade. For example, where the subsoil is sandy or of a gravelly nature, which insures good natural underdrainage conditions, reinforcement would be of the least value, while in cuts through clay hillsides it would be of maximum value. It also should be kept in mind that so far as our present knowledge goes, there is little or no value to be attached to the portion of the reinforcement which is laid longitudinally. Therefore, that type of reinforcement should be used which employs a maximum portion of the metal, transverse of the road.

The tendency has been for an increased use of reinforcement in the construction of concrete roads. Whereas comparatively few concrete pavements were reinforced in the

period from 1909 to 1914, of those that were built in the years 1914 to 1916, inclusive, nearly 32 per cent. were reinforced.

Acknowledgment

The foregoing matter is from the lecture on: "The Development of Concrete Road Construction, by Mr. Johnson, reprinted from the J. E. Aldred Lecture on Engineering Practice, The Johns Hopkins University Press, 1918.

LAYOUT of SHORE ROAD JOB
MACOMB COUNTY, MICH.

Low Hauling Cost and No Waste of Material on Construction of Michigan Road

Number of Men Required Less Than Usual—Hauling On Grade Eliminated By Material Handling System

The use of a complete mechanical system for handling material, by means of which the waste is unusually low, hauling on the grade is unnecessary, handling costs are lowered and the number of men required is considerably reduced, is the outstanding feature of the construction of 3½ miles of road in Macomb County, Michigan. The job is near Mt. Clemmens, on what is known as the Shore Road, about 18 miles from Detroit. An 18-ft. roadway is being built with a 5-in. concrete base covered with a 2-in. layer of asphalt.

Loading Material

The mixture used consists of 1 part cement to 6 parts of lake gravel. This gravel is pulled from a dredge by a dragline and is loaded into bins with a steam shovel, as shown in Fig. 1. These bins were constructed with a clearance between top of car and bottom of bin of 7 ins., so that the material would not flow over the edges of the cars if the gates were left open by careless workmen. Thus the waste of material at the loading point has been prevented as evidenced by the absence of sand piles around the cars in Fig. 2. With this system two men load an 8-car train of 16 batches in 6 to 8 minutes.

Plant Layout

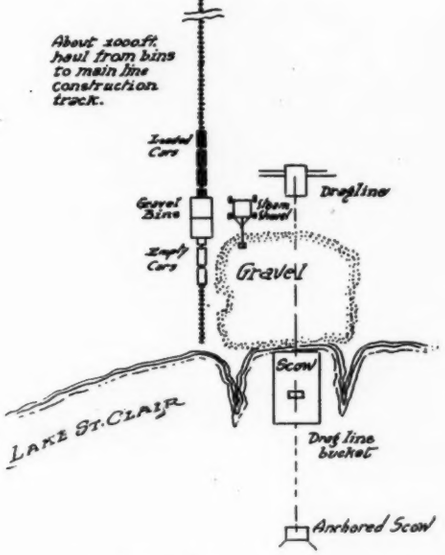
Four loaded cars are pulled by a team of horses from the bins, up a slight grade, to the first siding on the road, as shown in the layout sketch herewith. The team then returns

FIG. 1. SAND BROUGHT BY DRAGLINE TO SHOVEL AND LOADED INTO BINS. FIG. 2. WASTE OF GRAVEL PREVENTED BY SMALL CLEARANCE BETWEEN BOTTOM OF BIN AND TOP OF CAR.

for another string of four cars and the train of eight loaded cars is ready to be hauled to the mixer by a gasoline locomotive which has brought back a string of empties. The track connecting the loading bins with the main line is located just about midway between the east and west ends of the road to be built. This arangement keeps the length of haul at a minimum for all parts of the job.

Concrete Mixing

Each car carries two boxes each holding 20 cu. ft. of lake gravel. The mixer is fitted with the Lakewood batch transfer attachment from which a bail is hung as shown in Fig. 3. This bail is so balanced that it wil stay open, thus permitting a train to move under it without the necessity for swinging the derrick. By means of this apparatus a box of gravel is



lifted from the car and dumped into the loading hopper. Three bags of cement are then added and the batch is ready to be mixed. With this arrangement only five men are needed at the loading end of the mixer—three to discharge a box full of gravel into the hopper and two to handle cement. This

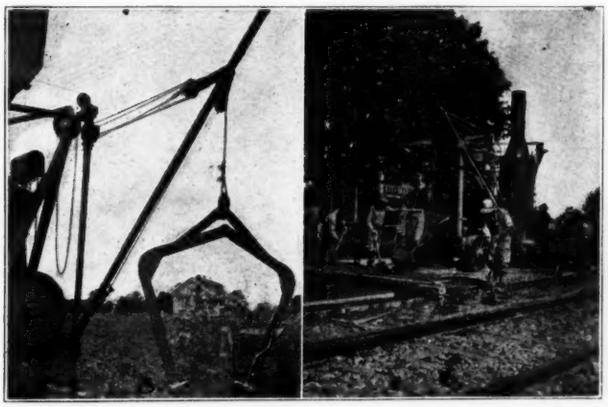


FIG. 3. BATCH TRANSFER ATTACHMENT FITTED WITH BAILS TO LIFT BOXES FROM CARS. FIG. 6. FOUR MEN NEEDED AT DISCHARGE END OF MIXER.

is shown in Fig. 4, which also shows the grade free from piles of material due to the methods employed. Also, observing the actions of the men and judging from several pictures taken after a batch was loaded, the men seem to come to rest each time in about the same positions shown in Fig. 5. This would indicate that their work had become almost automatic and, therefore, more efficient. Four men are needed at the discharge end of the mixer as shown in Fig. 6.

Work was started at the west end of the job. Cement was stored in several sheds along the road. It was hauled from the sheds to the mixer in cars, as shown in Fig. 7. Each car holds 60 bags of cement.

Crossing D. U. R. Tracks

As the road parallels the tracks of the Detroit United Railway a method of crossing these tracks with the narrow gauge track was devised as shown in Fig. 8. Plates were bent at right angles, bolted to the bottom of the light rail and to the web of the heavy rail so that the top of the light rail would be held 1¼ in. above the top of the heavy rail. The 20-lb. rail was cut to make a 5-in. gap where the heavy rail had to be crossed. With this arrangement the flange of the 12-in. wheels on the small cars just touches the top of the heavy rail and the chances of derailment are almost eliminated. In fact, no derailment has occurred at this crossing to date.

The work is being completed at the rate of about 400 ft. a day. The best day's work is 512 ft. of finished concrete base.

The layout of the job is indicated by the sketch. As the work progresses the siding nearest the mixer is moved forward about ¼ mile. The moving of these switches is a comparatively easy job as the track is built in 15 ft. sections, and can be quickly taken apart, moved, and assembled.

Advantages of Method of Handling Material

The advantages of this method of handling material are, briefly: A large capacity plant can be used on very narrow roads; there is no loss of material; materials are kept clean because no aggregates come in contact with the ground; proportioning the mix is made simple by the uniform amount of aggregate transported by each car; work is not delayed by bad weather, as muddy subgrades do not interfere with handling the aggregates.

The contractor is Thomas E. Currie, Detroit. The track, switches, cars, mixer and mixer attachments were supplied by The Lakewood Engineering Company, Cleveland, and the plant layout was suggested by that company's engineering department. An Erie shovel is used to handle the sand and a Plymouth gasoline locomotive hauls the cars. The concrete work was started about July 18th, and at the time this article was written a little more than 1½ miles of concrete had been laid.

FIG. 4. ONLY FIVE WORKMEN NEEDED AT CHARGING END OF MIXER. FIG. 5. MEN'S ACTIONS BECOME ALMOST AUTOMATIC.

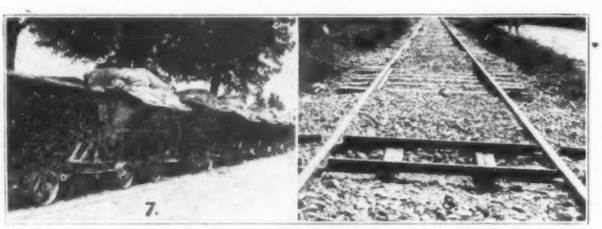
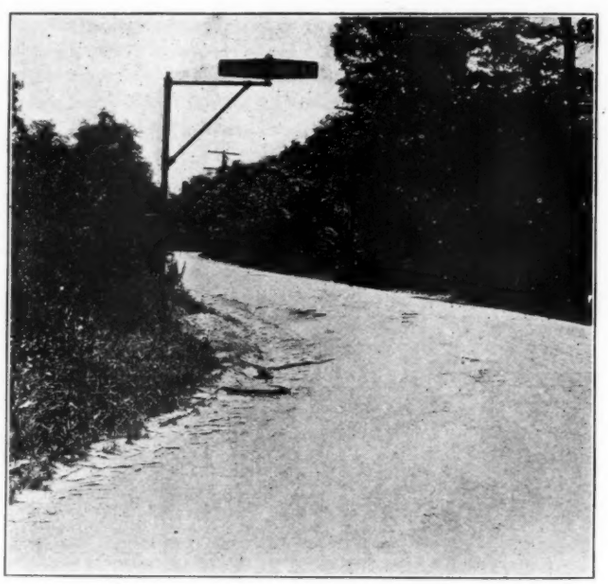


FIG. 7. CEMENT HAULED IN CARS FROM STORAGE SHEDS TO MIXER. FIG. 8. RIGID CROSSING MAKES DERAILMENT ALMOST IMPOSSIBLE.

Protecting Dangerous Curve on Sheridan Road

As a safety measure to forewarn vehicles of dangerous curves on Sheridan Road through Hubbard's Woods, Winnetka, Ill., the village of Winnetka has installed one of the A. G. A. Railway Light and Signal Company's acetylene-lighted highway danger signals. The installation is illustrated herewith. In this locality there are several steep grades and bad curves where the road winds through the ravines and curves around the small wooded hills.

This signal operates continuously, giving a flashing red light, which may be seen in the daytime as well as night. While during daylight this flashing red light may be distinctly seen at a distance of 200 to 300 ft., it is not so compelling in its indication as after dark, when the effect is very striking, and the light could undoubtedly be seen for a distance of two or three miles on a straight road and in clear weather.



A. G. A. ACETYLENE-LIGHTED HIGHWAY DANGER SIGNAL AT DANGEROUS CURVE ON SHERIDAN ROAD, NORTH OF CHICAGO.

The words, "Slow—Danger," are visible in the night as well as during the day. At night the white flame, which flashes through the red lens, illuminates also the letters of the sign,

so that the words are distinctly visible for a distance of about 200 ft., which is also about the same distance in which they can be seen by daylight.

It is expected that the village of Winnetka will soon install several more of these signals, making the protection by signals for all dangerous places in Hubbard's Woods complete.

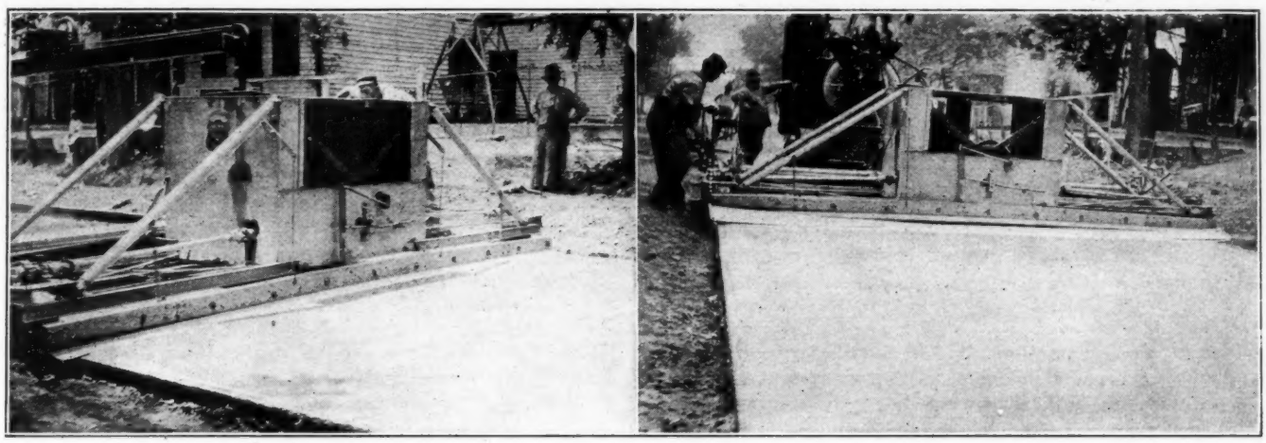
Road Finisher Increases Density of Concrete

A concrete road finishing machine that eliminates the voids in concrete, here illustrated and described, is an important addition to the Lakewood Engineering Company's line of road construction plant. The use of the machine permits an increase in the proportion of coarse aggregate, and the rapid agitation of the aggregate makes possible the use of an unusually dry mixture. In general it may be said that the use of this concrete road finishing machine permits the use of a drier, coarser mixture than could be worked by hand.

The device moves forward under its own power at a speed of about 7 ft. per minute and backs up at a speed of 28 ft. per minute. As the machine travels forward the strike-off spreads the concrete to the necessary height and proper crown. The tamper, located just back of the strike-off, tamps the concrete the first time over with a long, hard stroke. The second time over a short, rapid, up-and-down movement is used, which may be decreased until it is subjecting the concrete to continuous agitation without applying pressure to the mixture. The stroke of the tamper is regulated by the operator and may be varied for different consistencies of concrete as well as for different stages of progress. The float, located at the rear of the machine, produces a smooth finish by sweeping a belt across the surface at a comparatively slow speed.

By subjecting the mixture to the continuous agitation caused by the tamper, the concrete is compacted and the air in it is brought to the surface. The larger stones and only enough mortar to cement them are brought together. Because of the agitating action of the tamper a drier mixture can be used with the Lakewood finisher than would be possible where the work is done by hand. This, of course, results in a stronger concrete and produces a surface free from laitance, silt and light particles which float to the surface of a wet mixture.

The views show the Lakewood concrete road finisher in



VIEWS OF NEW LAKEWOOD CONCRETE ROAD FINISHER IN USE ON 15 FT. BELLEVILLE (ILL.) SCOTT FIELD ROAD IN ST. CLAIR COUNTY.

use on the 15-ft. Belleville (Ill.) Scott Field road, in St. Clair county, where its use has been attracting considerable attention from engineers and contractors. On this work a 1:2:3½ mixture is being used. The Belleville work is being done by Keeley Brothers, of East St. Louis. D. O. Thomas is county highway engineer and Frank Sheetz is engineer in charge of the work. The concrete road will be 6 miles long, 15 ft. wide, 6 ins. thick on the sides and 7½ ins. thick at the center.

The finisher was designed in 1913 by E. G. Carr, while a contractor in California. This type of machine has been used on the construction of about 400 miles of California's famous highways. It is manufactured by the Lakewood Engineering Company, Cleveland, Ohio.

WATER WORKS DESIGN AND CONSTRUCTION

Construction Methods Employed in Building the New Intake and Remodeled Reservoirs of the Oshkosh, Wisconsin, Water Works.

By T. B. Jorgensen, Resident Engineer, Oshkosh, Wis.

In connection with the recently constructed water filtration plant, described in the July issue of MUNICIPAL AND COUNTY ENGINEERING, the city of Oshkosh awarded a contract for the construction of a new intake and a connection between the old intake and the new filter plant. The plans and specifications for the intake were prepared by Col. Henry A. Allen, of Chicago. J. Rasmussen & Sons Co., of Oshkosh, were the contractors.

The New Intake and Crib

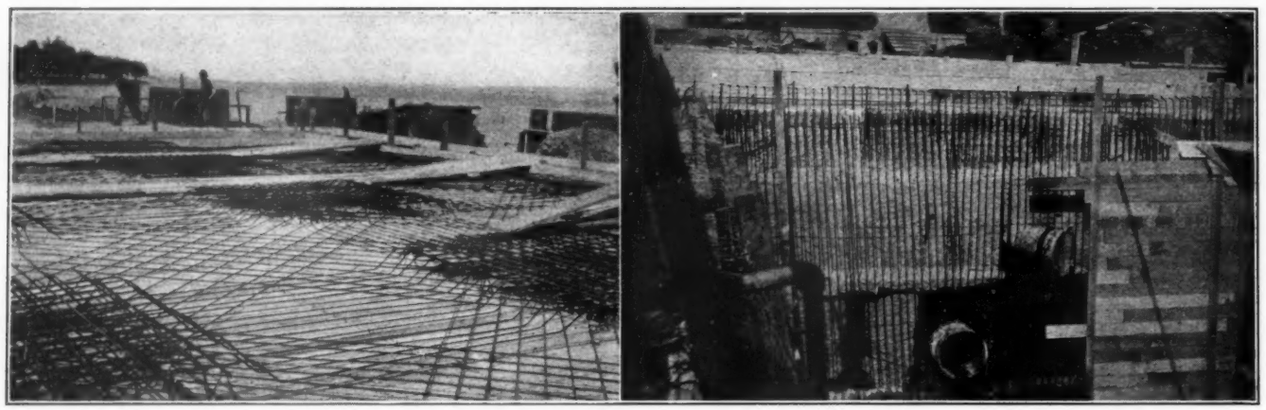
The new intake consists of about 300 ft. of piping connecting the shore line with the suction well in the filtration plant, and 1,200 ft. of piping from the shore line out in Lake Winnebago. It is constructed of 24-in. cast iron piping, Class B, bell and spigot, with three-ball joints, in the lake section, for expansion.

At the extreme end is constructed a submerged concrete crib, supported on pile foundation, with its high point 9 ft. 8 ins. under low water level. The work was started in the early fall of 1917 with excavation for the crib.

It was our original intention to build a cofferdam around the location of the crib and then build the concrete crib right

in place on its pile foundation. Consequently the contractor built the cofferdam of 3-in. plank in three layers, so that the two outside layers covered up the joints of the center sheets. It was then covered with canvas on the pressure side and banked up with dirt to about half its depth. Rigid framework braced the wall from the inside.

The sheet piling was driven to refusal in quicksand mixed with clay. Upon pumping out the cofferdam we discovered that the bottom would not hold, as the water broke through, carrying with it sand, thereby making it impossible to keep our excavation low enough for the bottom of the crib. After driving another cofferdam round the first one, with even a deeper penetration, we were not able to maintain our excavation. In order to eliminate the upward water pressure on the bottom inside the crib and to enable us to maintain our excavation, we filled the cofferdam and excavated to the proper elevation with the dredge, after having removed the inside bracing, that interfered with the excavation.



VIEWS OF REMODELED RESERVOIR OF OSHKOSH WATER WORKS.

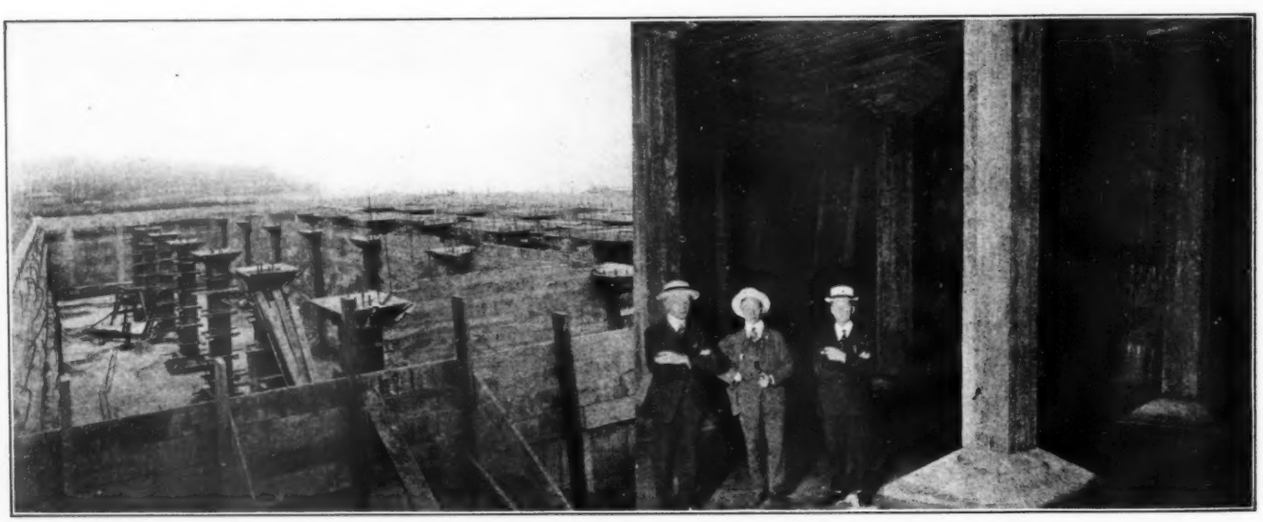
Left: Reinforcement in Flat Slab Roof Over South Reservoir (Old Settling Basin). Right: Formwork for Lining in North Reservoir with Triangle Mesh Reinforcement.

Crib Construction Difficulties Solved

We then proceeded with the construction of the crib on top of the cofferdam by placing stringers supported by the sheeting and laying a solid floor of 6-in. timber, upon which we built the forms for the crib, placed the reinforcement and the necessary castings and poured the concrete. After the crib was completed we lowered the entire crib, which weighs about 30 tons, with six threaded rods, supported on nuts, which again were supported by heavy timber horses. The operation of lowering this weight was very simple, merely unscrewing the nuts evenly on all six rods until the bottom of the crib struck the pile foundation.

The fact that we constructed the crib on top of the cofferdam made it less expensive to construct and gave us a better job than we could have expected inside the cofferdam. By the time the crib was completed the ice came, covering up the entire lake. As the city was in urgent need of this intake, we started to lay the pipe from the ice; that is, we located our dredge at the shore point of the line and kept a channel open sufficiently far ahead for our progress. As the pipe is practically level, we had about 12 ft. excavation next to the shore, gradually diminishing to about 2 ft. next to the crib. The pipes were lowered in sections of three and four lengths, with all joints that were made on shore of poured lead and the joints made under water were caulked with lead wool, with the exception of the flexible ball joints, which were flanged.

The advantages we observed by placing the line from the ice were that we were independent of weather conditions and the rough lake on windy days and that no extra barge was required for the handling of the pipe, as the pipe sections were hauled out on the ice and placed alongside the channel, where they were picked up by the dredge boom and lowered



VIEWS OF REMODELED RESERVOIR OF OSHKOSH WATER WORKS.

Left: Construction in Progress in North Reservoir (Old Storage Basin). Note Dowels in Old Wall and Baffle Wall along Center Line of Reservoir. Right: Interior View of Old Settling Basin After Being Roofed and Ready to Store Filtered Water.

into the excavated bed. The contractor managed to reduce his cost of keeping the channel free from ice by cutting the ice and selling it to a local ice company.

Where the pipe line connects to the crib there is a 24-in. valve, and this was closed during the final tests. These tests were conducted by putting the entire line under a pressure of 30 lbs. per sq. in. from an elevated tank in the filter plant. A 10-in. pipe is connected from the riser pipe to a point on the intake immediately outside of the suction well in the filter plant, into which the intake discharges.

After having put the line under pressure several times for the purpose of discovering any leaky joints, which were recaulked, we finally got a perfectly tight job holding a pressure of 30 lbs. per sq. in. At the acceptance of the crib and intake the writer put on a diving suit and inspected the line and the crib.

Remodeling of Old Reservoir for Increasing the Storage Capacity of Filtered Water

At the time the new filtration plant was contemplated contracts were also let to remodel and cover up two storage basins which were used by the old water works, one for clear water storage and one for a settling basin. Their respective capacities are 1,300,000 gals. for the clear water basin and 700,000 gals. for the old settling basin.

The basins were both in a very poor condition, with cracked concrete walls without reinforcement. However, they were heavy enough to withstand the water pressure as a gravity wall. The work started first on the old settling basin, which was the worst of the two, and about 2 ft. lower than the other basin.

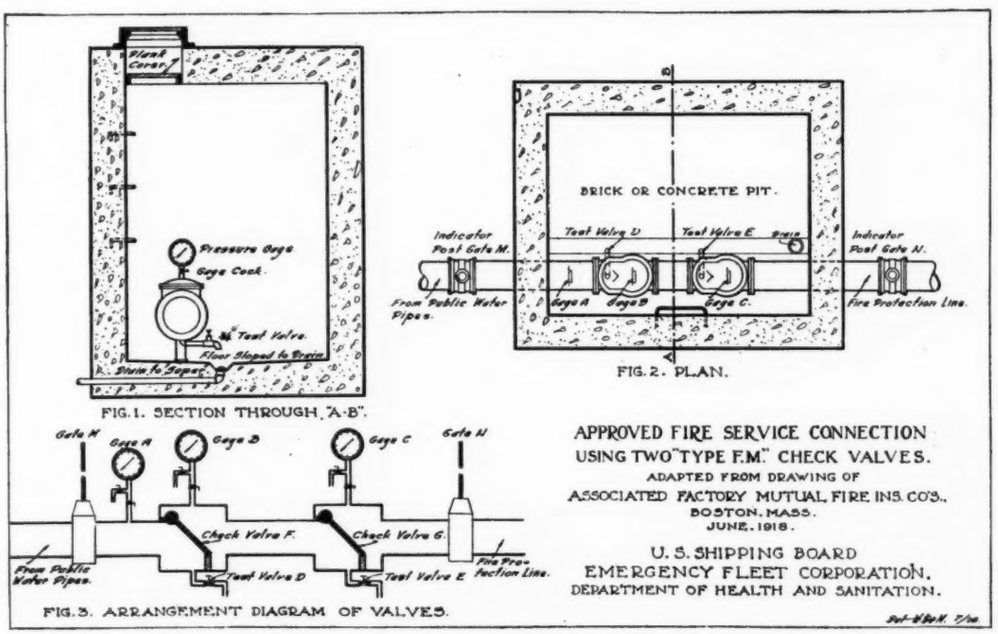
This is now completed and filled with water, while the work on the other basin is still under construction. The inside face of the walls was stepped off in four steps and the depth of 14 ft. was increased to 17 ft. To put these walls in a water-tight condition we gave the entire surface a 6-in. concrete lining, with heavy triangle mesh reinforcement. Dowels were placed in the walls about 4 ft. apart, also on top of the old walls. The concrete mixture in this lining was 1 part cement, 2 sand and 4 of roofing gravel mixed with smaller size crushed stone. The lining reinforcement was bent over at the top extending up to the height of the extension of the wall, which was poured in conjunction with the lining.

The roof of the basin is supported by columns about 16 ft. centers, and is of flat slab construction. Baffle walls were poured in between columns for the purpose of maintaining circulation of the water at all times and eliminating all dead space. The old piping is used and so arranged that each basin can be used independently. In the roof are placed manholes and ventilating shafts covered with a casting. As both basins are going to be covered with 1 ft. of dirt, the ventilating shafts are elevated to about 4 ft. over the top of the roof. The same construction method is now being used for the other basin.

As the floors were in poor condition, an extra 4 ins. of concrete was placed, reinforced with light triangle mesh. When the reservoirs are completed the earth level around the new filtration plant extended over the two basins will entirely conceal them, and at the same time will aid in keeping the water supply of the city cool in the summer.

Plans and Specifications for Dual Connections

The plans and specifications for dual water service connections given herewith are those of the Department of Health and Sanitation of the Emergency Fleet Corporation, of which Lieut. Col. Philip S. Doane is director and W. L. Stevenson is sanitary engineer. This department was created for the purpose of performing the same functions toward the shipyard workers as a state board or department of health per-



forms toward the citizens of a state, a bulletin was prepared by the department giving standards of practice. What follows is from the bulletin:

As the purity of the water supply is absolutely essential to health, there should not be any connection between the mains or pipes carrying drinking water and those carrying unpurified water used for industrial purposes or for fire protection.

In case unusual conditions indicate necessity for dual connections and if such be authorized by the Department of Health and Sanitation and approved by local and state health officials having lawful jurisdiction in the premises the same shall consist of two check valves, three pressure gauges and two blow-offs, installed in a manhole of ample size for convenient operation provided with a drain to carry away water blown off during tests.

The specifications for these check valves must require the seat ring, disc, holding ring and screws, disc stud, arm hinge pin and bushings to be of bronze; disc to be faced with me-

dium hard rubber, and that liberal clearances shall be left around clapper and arm in all positions.

This type of "fire service connection" is shown in the diagrammatic illustration. Normally, indicator post gate valves M and N are open and test valves D and E are closed. At monthly intervals a test should be made of the tightness of the check valves, and at intervals of about three months the bonnets of the check valves should be removed and the checks and their bearing seats carefully cleaned. To facilitate removal of bonnets, manilla paper packing, soaked in machine oil, should be used and bolts greased with heavy oil and graphite. To make test of lightness of check valves, close valve M and open valve D. Pressure on gauge A should fall to zero and on gauge B hold. Valve E should now be opened and pressure on gauge B should fall to zero and on gauge C hold. The principle of this test will be clearly seen by examining Figure 3 of the drawing. After test is completed valves M and N must be left open to permit flow through the connection.

City of Detroit Offsets Labor Shortage by Using Machinery for All Water Main Construction

Public service officials who have essential water or gas pipe lines to lay are confronted with the same obstacle that exists in all fields of construction—labor shortage. The result of this condition is a large increase in the use of machinery for excavating trenches, handling pipe, caulking joints and backfilling and tamping trenches.

The experience of the Board of Water Commissioners of the city of Detroit is probably typical of that of many of these public utility officials who turned to machinery when they found their work hampered by the scarcity and high cost of labor. The Detroit water commissioners not only overcame the labor difficulties but at the same time vastly speeded up their work by the use of machinery.

The Machinery

They now own and operate the following machines: Four Austin trenching machines, two Buckeye trenching machines, three Austin backfillers, two Oshkosh backfillers, one Wonder "Double Quick" backfiller, two Bucyrus cranes, one Chicago pneumatic compressor, and one Buckeye concrete breaker. These machines represent a total investment of about $40,000. A few of these machines were purchased late in 1916 and in the spring of 1917 and were utilized during a portion of the year 1917 with the result that the total of water mains laid exceeded that of any year in the history of the board. During the present year machinery has entirely replaced hand labor.

Accurate records have been kept of each day's work of each machine. The records of the trenching machines are particularly interesting as they tend to show that any public service engineer who says he can excavate pipe line trenches more cheaply by hand than by machine must have had experience only with hand excavation.

Machine Performance Data

A Buckeye gasoline ditcher dug 28,234 lin. ft. of trench for 6 and 8-in. pipe in the first six months of 1918 at an average cost per foot of 4.7 cts. Working on trench for 12-in. pipe, an Austin gasoline ditcher during the same period dug 18,112 lin. ft. of trench at an average cost per foot of 5.7 cts. A large type Austin gasoline ditcher excavated 5,528 ft. of trench approximately 6 ft. 4 in. wide and 12 ft. deep at an average cost per foot of 26.8 cts. Another Austin ditcher of the same type, but operated by steam, dug 6,481 lin. ft. of trench for 48-in. pipe at an average cost of 31.2 cts. per ft. Considerable of the work of the two large machines was done during January, February and March, when they had to cut through ground frozen to a depth of 2 to 3 ft.

NON-TRACTION TYPE OF SMALL BACKFILLER.
One of these Wonder "Double Quick" Machines Backfilled 14,986 Lin. Ft. at Average Cost of 3.1 Cents per Ft.

THIS IS HOW LARGE PIPE IS HANDLED.
Bucyrus Steam Shovel-Cranes Replace Derricks for Stringing and Lowering Pipe.

Wages and Cost Accounting

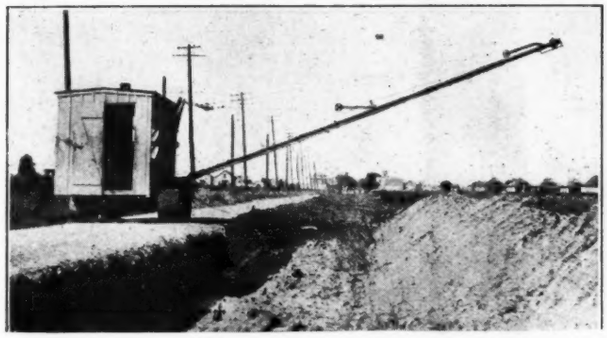
These costs include everything connected with the operation and maintenance of the machines, viz: wages of opera-

THREE OF THE MACHINES USED ON DETROIT WATER TRENCH CONSTRUCTION. AT LEFT IS AUSTIN TRENCHING MACHINE WORKING ON TRENCH 6 FT. WIDE AND 12 FT. DEEP. THE MIDDLE VIEW SHOWS AN AUSTIN BACKFILLER. THE VIEW AT RIGHT IS A BUCKEYE MACHINE USED ON DITCHING FOR 6 AND 8 IN. PIPE.

tor and assistant, cost of moving to job and from one job to another, cost of repairs, gasoline (or coal), oil, overhead and depreciation. The cost of maintaining two mechanics to look after all the machines is charged to overhead and split up among the productive machines which are out on the various jobs; for instance, if these two mechanics are costing $20 per day and ten machines are in operation on a certain day, $2 will be charged against each working machine as "overhead" for that day.

Depreciation is figured at so much per lineal foot of trench excavated, varying from ½ ct. per ft. for the smallest machine up to 2 cts. per ft. for the big Austin machine used on trench for 48-in. pipe. This is not offered by the Detroit department as an absolutely accurate way of figuring depreciation, but it seems like a fair solution. The trenching machine operators are now paid 85 to 90 cts. per hour and the assistants 50 and 55 cts. per hour.

Only good mechanics are employed as operators and they are expected to keep their machines in first class shape.



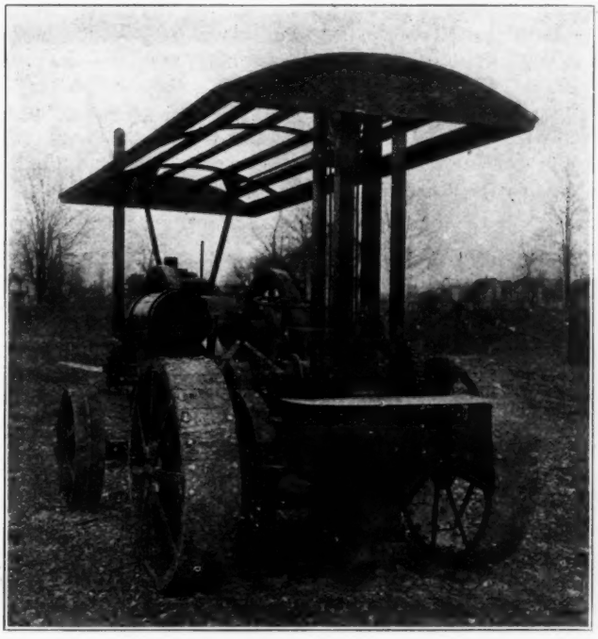
SOMETIMES CONDITIONS WERE IDEAL.

But this same machine also worked right through the winter when ground was frozen. It is an old type Austin Backfiller Without Caterpillar Traction.

When a machine is idle for a day or so between jobs the operator is expected to put in his time carefully looking over the machine, and this is charged to repairing instead of operating cost. If a machine is to be idle for a longer period the operator comes in and makes himself useful in the stock room or repair shop at the main storage yard of the Board of Water Commissioners.

Performance of Backfillers

All the trenches this year have been backfilled by machine and at very low cost. The three light backfillers used on small ditches showed average costs for the period from January to June, 1918, of 3.1, 3.3 and 3.6 cts. per lin. ft. of trench backfilled, the lowest cost being credited to a non-traction type Wonder "Double Quick" machine manufactured by the Waterloo Cement Machinery Corp., of Waterloo, Ia. The large ditch backfilling, as well as a portion of the small ditch work was handled by three backfillers of the boom type manufactured by the F. C. Austin Co., Inc., Chicago. Two of these



"BUCKEYE" CONCRETE BREAKER.

Very useful when Trenches have to be Cut Through Pavements.

machines were mounted on round wheels and one was a late model equipped with caterpiller traction which handles much easier than the machines with round wheel traction. One of these Austin backfillers which was used on both large and small ditches and contended with frozen soil on some jobs, backfilled 16,525 lin. ft. at an average cost of 4.6 cts. per ft. The costs for the backfillers were figured the same as for the trench excavators except that the depreciation charges were ½ ct. per ft. of trench backfilled for the small machines and 1 ct. per ft. for the large machines. Backfiller operators received 50 to 60 cts. an hour, depending upon the size of the machine.

Handling Pipe

Bucyrus steam cranes are used for loading and unloading pipe and lowering large pipe into trenches. The board owns two of these machines. In stringing and lowering pipe they are much safer and cheaper than the old style derricks which

THE DETROIT WATER COMMISSIONERS USE TWO OF THESE OSHKOSH BACKFILLERS ON SMALL TRENCHES.

they replace. One of the cranes is equipped with combination crane boom and dipper stick and is readily converted into a steam shovel by attaching a dipper.

Caulking Joints

A Chicago Pneumatic Tool Company air compressor does all the caulking on large pipe, replacing the gang formerly required for this work. In the six-month period, January-June, 1918, it caulked 738 joints of 48-in. pipe at a total cost of $837.88, including labor of operator (who received 60 cts. an hour), moving and repair cost, oil, gas, overhead and depreciation. In joining small ppe "Metalium" was used. This is a metaloidal alloy manufactured by the Metalium Refining Co., Omaha, Nebr. It requires no caulking.

Concrete Breaker

An interesting machine, the Buckeye Concrete Breaker, is being successfully used where trenches have to be cut through pavements. The machine breaks up the asphalt or concrete pavement ahead of the trench excavator, and has done very valuable and efficient work. It is a product of the Buckeye Traction Ditcher Co., Findlay, Ohio.

THE EMERGENCY REPAIR FLEET.

Motor Truck Fleet

Loss of time due to breakdowns has been reduced to a minimum by the methods adopted. One of the accompanying illustrations shows the emergency fleet of automobiles which is ready at all times at the storage yard to answer a call from one of the jobs. In addition, there is a 5-ton Packard truck equipped with lathe, drill press, grinders, air compressor, forge, etc. A complete stock of parts for all machines is carried in the repair shop at the storage yard.

The whole story of how speedily and economically Detroit has laid its largest annual mileage of water pipe during a period of critical labor shortage, cannot be written until complete cost figures are available. Enough has been set forth here, however, to make clear the part that machinery had in the accomplishment. The author is indebted for most of his information to Mr. L. J. Clancy, assistant general superintendent, and Mr. Edward Frey, supervisor of machines, of the Detroit Water Works Department.

DIGGING TRENCH IN LOOSE CAVING SOIL.
This shows some of the Difficult Work Handled Satisfactorily by the Detroit Machines. Austin Ditcher in the Distance.

WATER PURIFICATION AND SEWAGE TREATMENT

Sewage Treatment Policies as Influenced by War-Time Conditions

By George W. Fuller, Consulting Engineer, 170 Broadway, New York, N. Y.

The stress of war conditions has brought to the front several viewpoints concerning municipal sanitation which are worthy of most careful consideration. Some of these have been well outlined by Messrs. Kenneth Allen and T. Chalkley Hatton in recent issues of this journal. Others have arisen for discussion by sanitary engineers and mention may be made of the following:

War-Time Considerations

1. Shortage of funds, materials and labor, means that for a term of years money devoted to public health work should be spent so that the return per dollar of investment will be as high as practicable under the new conditions when viewed both in absolute and relative terms.

2. The large army camps, particularly in the Southern States, have revived the question of transmission of diseases by insects, and sanitary engineers unquestionably must renew their efforts to become familiar in a practical way with insecticides and other lines of work of the entomologist.

3. Recovery of grease from kitchen wastes at army camps is a practical proposition, both with respect to conservation of fats and the bearing which the undertaking has on the composition of sewage in relation to treatment and disposal.

4. High prices and shortage of farm labor mean that more attention to fertilizers should be given in farming operations, and this, in turn, should stimulate increased attention, not only to activated sludge, but to the recovery of plant foods from sludges obtained from coarse-grained filters and other sources.

5. Factors of safety should be considered anew for sewage treatment procedures, not only from the standpoint of seeing that money is spent where there is urgent need for treatment

plants that will do the most good per dollar of cost, but also that the operating procedures are commensurate and adequate at those seasons of the year and under varying local conditions, in the interest either of the public health or avoidance of gross nuisance, or both. Perfunctory adoption of sewage treatment procedures for twelve months in the year is not necessarily wise, as there are many cases where there is real need of effective sewage treatment during the bathing period, but where during the winter months disposal of raw sewage will do far less harm than indifferently operated treatment works during the summer.

All these subjects could be discussed at great length. It is not the intention in this brief article to do more than explain the general viewpoint in hope that sanitary engineers, particularly those interested in sewage disposal, will recognize that they have responsibilities in adjusting their technique to the new regime of affairs incident to the role which every one must now play as a result of the world war.

Where Will Investments in Sanitary Works Do the Most Good?

American municipalities for years have shown a fondness for proceeding in a hit-or-miss, or perhaps rule-of-thumb, method in handling sanitary problems. As to sewage disposal, it has been the vogue to defer investments until the courts or state departments of health have forced the issue, and then to show an unfortunate tendency to get but little return on the plant investment in consequence of indifferent operation.

For some years a better state of affairs has been developing as a result of city planning along various lines of municipal investments, and annual budgeting has caused more and better attention in some cities to be given than hitherto to operating city owned works efficiently.

Municipalities, like individuals, must now economize. Earlier custom should no longer be accepted without investigations as to adjustment to the new conditions. Practical deductions must be made as to the significance which current evidence produces, and studies must be made to record anew the procedure which is best for all municipal departments.

Sanitary problems must be considered in the light of whether in the past money has been spent in ways which do not now give as good a return in the interest of the public health as would develop along other channels. We must face anew the problem of where a dollar will do the most good in the interest of the public health. Sewage disposal is only one of the branches of municipal sanitation. The whole question should be reviewed from the standpoints of investment and operating expense in relation to the needs for each city in this particular line. And such results should be weighed most carefully in comparison with investments and upkeep needs along other lines in the sanitary field.

Insect Control

Since the days of the Spanish-American war, and before that time, the sanitary engineer has known of the general importance of insects in the transmission of disease. He has been interested in mosquito elimination and knows that sprinkling filters have caused at times an unusual prevalence locally of certain kinds of flies. At some plants this has been a real item for consideration. At other such plants flies seem to have been under control almost without exception, apparently due to the influence of other forms of life.

Appreciation of how flies thrive in some kinds of sewage sludges, and in the materials accumulating as films upon sprinkling filters of coarse material, shows that the engineer must apply himself to the practical study of the work of sanitary inspectors and entomologists. No longer can he be unfamiliar with insecticides as applied to suit his treatment procedures. Measures to control flies in relation to city garbage and to handling of stable manure are not necessarily applicable to the problem at a sewage disposal plant.

Practical knowledge of means of preventing or of killing flies must be acquired with more thoroughness by the sanitary engineer than has been the case hitherto. In particular must he familiarize himself with arrangements involving structural modifications of treatment plants, to the end that insects may be kept under proper control.

Flooding of sprinkling filters to kill moth flies by drowning, as is the case with contact filters, is a good illustration. This comes from the current work of Dr. Thomas J. Headlee, State Entomologist of New Jersey, in advising upon fly control at the sprinkling filter plant at Plainfield, N. J. In the course of this work studies have been made of the relative efficiency of different insecticides applied in different ways. Along these lines the technical operators of sewage treatment plants should at once become more proficient in the application of their practical knowledge.

Grease Recovery

At some of the army camps abroad grease from kitchen wastes is recovered and the proceeds from the sale thereof are applied to the mess fund. This is not necessarily the wisest policy to follow literally, but it does suggest for this country a phase of conservation that should receive more study than has been the case hitherto. At army kitchens the recovery of waste discharged through the sinks is, of course, more easily handled than is the recovery of grease from municipal sewage. However, this whole question is assuming new significance from several different angles and the sanitary engineer should not lag behind in his utilization of such knowledge.

For some time the disturbing influence of grease at sewage treatment plants has been appreciated. At institutional plants the benefits of grease recovery, in relation to subsequent treatment of the sewage, have been pronounced in some instances. As the problem has extended into the municipal field complications have arisen, as the value of the grease is less after it has been mixed with the sanitary wastes than when recovered from the kitchen drains without admixture with fecal matters.

As the problem broadens to include its relation to municipalities, where sewers contain industrial wastes, oils and fatty matters not readily suitable for grease recovery, new factors add their complicating influences, as compared with the kitchen drains at army camps. Because the sanitary engineer is not now well posted on the recovery of grease and fats is no reason why, as opportunity presents, he should not bend his efforts towards solving this type of problem where feasible.

Recovery of Fertilizing Elements

It is not the intention here to go into the value as plant food of activated sludge or sewage matters incident to other lines of treatment. The idea suggests itself forcefully that, with the present prices and shortage of labor, the fertilizer trade is likely to look in the future with more, rather than less, favor than it does now upon sewage matters in a form usable as plant food.

In passing, the comment may be made that the sludge from secondary tanks receiving the effluent of sprinkling filters is a product which farmers themselves have learned is a better fertilizer than is ordinary tank sludge. Farmers readily seek the material detached from stones found in waterways in which flow the effluent of coarse stone filters, and also the deposits settled from water used in washing clogged filtering material. This product is known in England as "slurry."

For sizable projects it is believed that this material should be considered as a fertilizer product, particularly as it is known that chloride of lime and other chemicals applied to coarse stone filters may bring about almost at will the detachment of the films on the filtering material. The problem for the sanitary engineer is to see how best to do this without destroying the films so completely as to interfere with the efficiency of the filter. The problem of freeing this product of water resembles that in the activated sludge process, and ef-

forts made to control odors should be along the foremost lines of investigation in the field of garbage disposal and odor-producing industries.

Factors of Safety

The mere fact that a community installs a sewage treatment plant does not necessarily have much, if any, sanitary significance. It is quite possible that accomplishments may transfer a nuisance from bodies of water to a nuisance on land, or result in both complications at the same time. If sewage treatment is really worth while, if for only three months during the year, it is better to see to it that this result is actually accomplished effectively for such a period than to allow the plant to be operated indifferently throughout the year, so that communities obtain a false sense of security. The economics of these problems, including capital charges, operating expenses, benefits really secured, with consideration given to direct and indirect damages, should be recomputed in the light of present knowledge.

Factors of safety should be studied in relation to the real need of sewage treatment, and accomplishments should be weighed in percentages of actual efficiency along sanitary lines. The mere name of an actual installation does not mean that sewage treatment is practiced with a due regard to a sound sense of proportion. Such judgment should be exercised, and if sewage treatment is not ordinarily necessary steps should be taken accordingly. Correspondingly, if sewage treatment is needed for a limited portion of each year, as has been actually found to be the case at a number of places in this country, this marks the procedure which should be followed out. If sewage treatment is needed all of the year, then a plant should be built adequately both as to type and size and operations conducted so that real safety is obtained.

There is just as much sense, and perhaps more need just now, in applying factors of safety to sewage treatment problems as to dams, bridges and buildings.

It is not the intention in this article to imply that engineers dealing with sewage treatment problems are the only ones who should take account of stock as to their broad technical procedure. All engineers face that responsibility, and have been moving in that direction with more or less speed for some time. All engineers are facing extraordinary responsibilities, incident to war conditions, and the sanitary engineers must do their full share.

Sanitary Precautions Taken Prior to Opening Wilson Avenue Crib and Tunnel of Chicago Water Works

By John Dill Robertson, M. D., Commissioner of Health, City of Chicago, and Herman N. Bundesen, M. D., Director of Field Force

Before describing the sanitary precautions taken prior to opening the Wilson Avenue Crib and Tunnel of the Chicago waterworks, it is well, for the sake of securing the proper perspective, to give in brief, statistical form certain essential information relative to the design and constructional features of the works:

Statistical Information

Preliminary work started April, 1913.

Tunnel started at Shore Shaft September, 1914.

Drifts 7 and 8 met, December, 1915.

Drifts 3 and 4 met, September, 1916.

Drifts 5 and 6 met, July, 1917.

Drifts 1 and 2 met, September, 1917.

Diameter of tunnel 12 ft. from Mayfair to Lake View Crib, 7 miles.

Diameter of tunnel 13 ft. from Lake View Crib to Wilson Avenue Crib, 1 mile.

Lowest point in tunnel: 140.8, shore shaft.

Highest point in tunnel: 97.0, meeting point of drifts 3 and 4.

Maximum monthly progress tunneling in one drift, 630 lin. ft., normal per drift 564 ft.

Maximum monthly progress concreting from one shaft 2,175 lin. ft., normal per shaft 1,178 ft.

Maximum daily progress tunneling: 28 lin. ft.; normal daily progress: 22 ft. per drift.

Maximum daily progress concreting, 60 lin. ft. per drift.

At a velocity of 4 ft. per second the 13 ft. tunnel carries 346,000,000 gals. of water per 24 hours.

The Lake View Pumping Station uses 100,000,000 gals. per day. The Mayfair Pumping Station will pump 152,000,000 gals. per day, which leaves a surplus of 94,000,000 gals. for future extension.

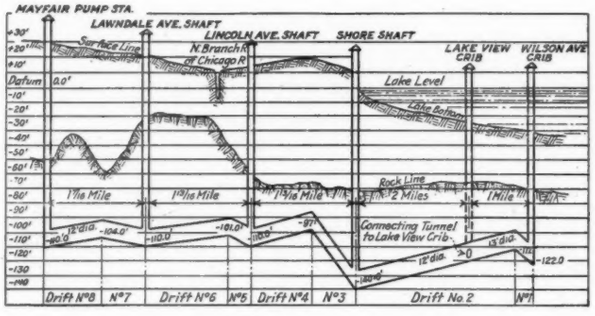
Excavation in 12 ft. dia. tunnel per ft. 6 cu. yds.

Excavation in 13 ft. dia. tunnel per ft. 7 cu. yds.

Number of bags of cement used, 865,420.

Number of one yard cars of excavated loose rock, 517,440.

Number of average trains of 25 cars each, 20,696.



PROFILE OF WILSON AVENUE TUNNEL OF THE CHICAGO WATER WORKS.

Saving of time by using tunnel rock for concrete: eleven to twelve months.

The lake end of the South West Land and Lake Tunnel, built by contract, 12,180 ft., 2.30 miles long, and using an intermediate crib, required four years and nine months to complete.

The lake end of Wilson Avenue Tunnel, built by City day labor from Shore Shaft, 14,850 ft. 2.81 miles long, without intermediate crib, required three years to complete.

The estimate for Wilson Avenue Tunnel and Intake Crib was $4,550,870. There was spent up to Dec. 31, 1917, $3,609,-132.97. Appropriation for 1918, to complete the work, $450,-000, leaving a balance of $491,737.03.

Lake View Crib Connection.

By a daring piece of engineering the Department of Public Works arranged to supply the Lake View Pumping Station with water from the Wilson Avenue Crib, thus getting a purer supply and saving the cost of operation and maintenance of the Lake View Crib.

At a distance of two miles east of the Shore Shaft an 8 ft. tunnel was driven from the Wilson Avenue Tunnel to a point under the shaft of the Lake View Crib, thence upward to within 10½ ft. of the bottom of the shaft, and a cast steel bulkhead was placed in the vertical section.

After the Mayfair pumping station was placed in operation the shaft of the Lakeview crib was extended downward to the steel bulkhead, the removal of which established a connection between the Lakeview and Wilson avenue tunnels.

Sanitary Precautions

Before the Mayfair pumping station was placed in operation the floor of the tunnel was liberally sprinkled with chloride of lime, which was allowed to remain there for several days.

In addition to this, after the pumping station machinery was started, the water was chlorinated at the pumping station and was then directly discharged into the sewers for three weeks. At this time the engines were pumping approximately 30,000,000 gals. per day.

Sanitary regulations were formulated under which the use of the crib as a water intake might be permitted to operate while construction work was still in progress, as follows:

1. That a chlorination apparatus be also installed at the crib for treatment of the water as it enters the tunnel shaft.

2. That a sanitary inspector be detailed by the Department of Health to the crib until construction work is completed. The sanitary inspector should be charged with the enforcement of sanitary regulations and should report to the director of field force in charge of city water with respect to infractions of rules and other difficulties encountered.

3. That the incinerators be placed in completely inclosed compartments. That one incinerator be used for fecal matter and that other incinerators be used for urine and for wash water. That the practice of discharging urine and throwing water into the coal pile be discontinued.

4. That cuspidors or pails containing chloride of lime solution be provided as receptacles for expectoration. That the contents of the cuspidors or pails be disposed of by emptying into an incinerator.

5. That signs be posted about the structure prohibiting employes or visitors from expectorating or disposing of any body secretions except into the receptacles provided.

6. That a supply of chloride of lime be kept at the crib at all times. That the floors be sprinkled with chloride of lime at frequent intervals. That chloride of lime be placed in all cuspidors and in all receptacles containing waste water. That the coal pile be treated with chloride of lime for several successive days after discontinuance of the present method of waste disposal.

7. That all employes be required to submit suitable specimens of urine and feces to the Bureau of Laboratories for typhoid examination.

(a) That present employes submit specimens as soon as practicable.

(b) That new employes submit specimens as soon as employed.

(c) That the names of all absentees among employes be reported daily by the sanitary inspector to the director of field force for investigation as to causes of illness.

8. That water samples for examination by the Bureau of Laboratories be collected daily from the Mayfair and Lakeview pumping stations until such time as the construction work at the crib is completed. That, pending completion of construction work, daily samples be collected by the sanitary inspector at the crib, except on days when samples are taken by the regular water sampler.

9. That the Mayfair pumping station shall not be placed in service until the aforesaid recommendations be complied with, and until it is found that the water at the station is safe. To this end, samples of water were taken at hourly intervals during the course of the day.

The feasibility of these precautions is demonstrated by the fact that of the men examined at the crib, one turned out to be a paratyphoid fever carrier, and should his dejecta have gotten into the distributing system, it might easily have caused an epidemic of paratyphoid fever in Chicago.

The Department of Public Works is to be congratulated upon insisting that a sanitary survey be made of all water tunnels, etc., before being placed in operation.

Recent Development in Equipment Used in Ozone Method of Water Treatment

By Irwin D. Groak, Consulting Engineer, Monadnock Block, Chicago

Since the discovery of the germicidal action of Ozone it has caused great activity in the scientific and engineering field; the results are many successes, and some failures. The generation, control and direction of ozone for the purification of water requires special engineering skill and practical experience, but it has been scientifically and definitely demonstrated that ozone completely destroys bacteria in water.

It is claimed by scientists, with whom the writer personally discussed the subject, that in the O_3, when the nascent oxygen is given up, that is when ozone breaks down into oxygen,

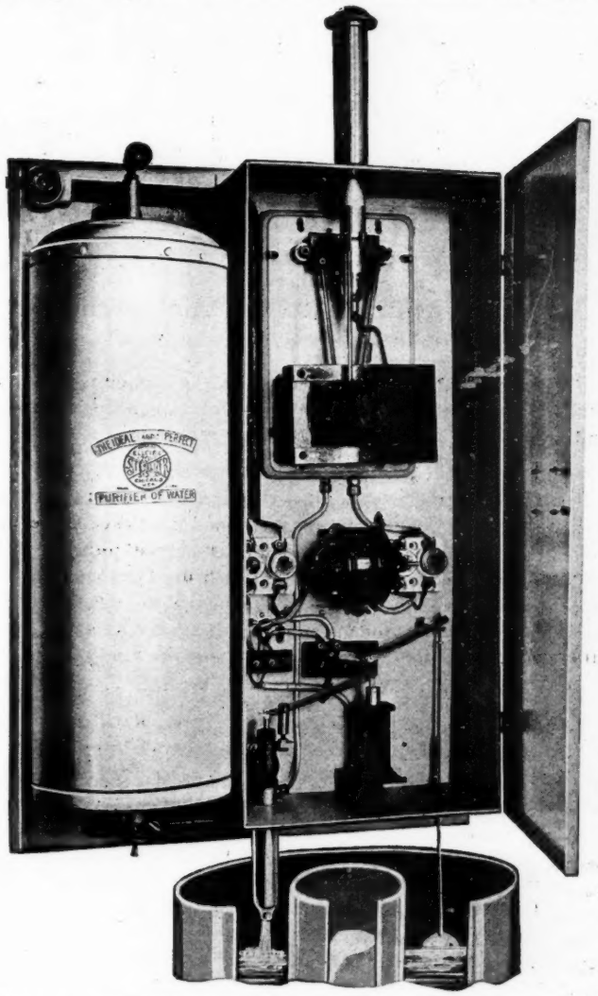


FIG. 1. AUTOMATIC OZONE WATER STERILIZER FOR USE ON SHIPS.

that not only one part of oxygen is acting on organic matter, but all three parts so act. This phenomena might be an explanation for the powerful action with which ozone attacks carbon, burning it up in the CO_2 and, after all, bacteria are nothing but carbon and water. Relatively the density of water to air is 1,000 to 1, and it requires one gramm of ozone diluted in one cubic meter of air thoroughly mixed with one cubic meter of water to make that water safe for drinking purposes, by destroying all the pathogenic bacteria. This is the average. In some cases less, and in others more ozone is required depending on the organic impurities or vegetation in the water.

Physical Improvement of Ozonated Water

Ozone is the only gas known today which if mixed with

water thoroughly in the proper concentration and quality will not only destroy all the pathogenic organisms, but will also take out the color, odor and taste due to organic impurities, producing a hygienically and physically desirable drinking water without any residue of the chemical left in the water, and without materially changing the mineral or inorganic quantities.

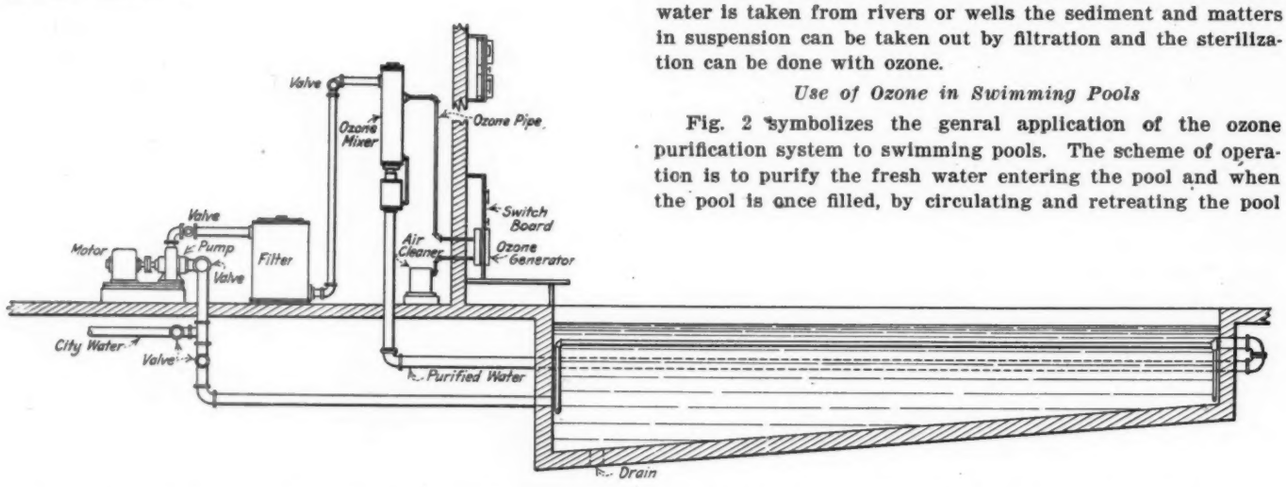


FIG. 2. DIAGRAM ILLUSTRATING THE GENERAL APPLICATION OF THE OZONE WATER PURIFICATION SYSTEM TO SWIMMING POOLS.

The problem before the engineer is the economical production of ozone by electrical brush discharge, and the design and application of it to meet different requirements.

Three New Ozone Machines

The Electric Ozone Sterilizer Company of America, Monadnock building, Chicago, are putting on the market three new machines. Fig. 1 is a view of a direct current ozonizer. As high frequency is required for the brush discharge about 6,000 volts are employed. It is stepped up from the original lighting circuit. Where alternating current is not available a rotary conveyor or motor generator set can be applied.

Ozone Water Purification for Use on Ships

Fig. 1 shows an electric ozone sterilizer machine entirely automatic in its operation, and of the suction type. The capacity ranges from 25 to 60 gallons of water per hour. For larger sizes the pressure type is recommended.

The operation is controlled by a float. The position of the float is determined by the height of the water in a reservoir. When the water supply is low the making of electric contact closes the circuit and brings a magnet into operation. This opens the faucet or mixing valve. The untreated water comes under pressure of 15 to 25 lbs., going through the mixing valve into an aspirator, creates a vacuum which causes suction, and the ozonized air from the generator passes into the water and is thoroughly mixed in the mixing chamber underneath the valve.

After the water reaches a predetermined volume, which is governed by the position of the float ball, the electric circuit is opened automatically, stopping the action of the ozonizer. Inside of the reservoir a cooling arrangement is provided either for ice or other means of refrigeration, as available.

This machine takes very little space. Without the reservoir it is about 22 ins. wide, 32 ins. high, and 10 ins. deep. It was designed to be used on ships where good drinking water is appreciated and needed. Passengers on a ship are dependent on a stored water supply, the purity of which is always in question. Electricity is available on every ship, and the quantity needed for purifying the drinking water is less than that required to light a small electric light bulb. This improvement means much to travelers, especially in war times when it is essential that the health of troops shall be kept at the highest attainable point.

Similar apparatus is designed to be used on ambulances and automobiles and hand carts for portable equipment. In this case a pump and filter is added so that in case the water is taken from rivers or wells the sediment and matters in suspension can be taken out by filtration and the sterilization can be done with ozone.

Use of Ozone in Swimming Pools

Fig. 2 symbolizes the genral application of the ozone purification system to swimming pools. The scheme of operation is to purify the fresh water entering the pool and when the pool is once filled, by circulating and retreating the pool water, it can be kept safe for the swimmers. There are many impurities to contend with, most important of which are from the bathers' bodies and clothes. Some of this matter can be taken out by filtration; therefore a centrifugal or piston pump keeps the water in circulation from the pool through a filter. After passing the filter the water flows through the ozonizer and back again into the pool.

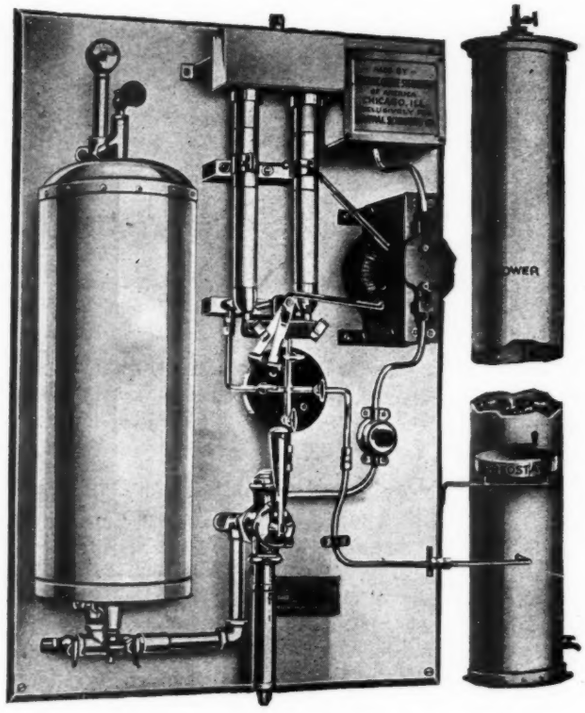


FIG. 3. LABORATORY TYPE OZONIZER FOR EXPERIMENTAL PURPOSES.

Three different methods can be applied and are recommended by the Electric Ozone Sterilizer Co. First, where the

ozonized water enters the pool at one place and the raw water or untreated water is taken out from the opposite end of the pool. Second, where the ozonized water flows into the pool from small holes arranged in a pipe alongside the wall of the entire pool. This method is more effective than the first. Third, where the ozonized water enters the pool from pipe nozzles laid under the bottom of the pool, carefully distributed. The third is the most effective of all, because the ozonized water carries a considerable amount of ozone which will help purify the water in the pool itself. The surplus ozone coming to the top of the water deodorizes the peculiar smell of the water and air on top of the water. It is not necessary to circulate all of the time, but as required.

The ozone purification of swimming pools is a paying proposition, besides being a health insurance. The reason for this is that it is cheaper to refilter and reozonize the water, than to buy fresh water and heat it; thus it helps in saving the coal supply.

Experimental Laboratory Equipment

Another, and probably one of the most interesting ozonizers ever produced, is a laboratory machine, which can be used by colleges, institutions, and industries, also by municipal laboratories to determine the amount of ozone necessary for the purification of water, and the concentration of it. Fig. 3 shows this ozonizer equipped with two tubes, an aspirator, mixing valve, and tower, so that either the suction or pressure system can be used with one or two tubes. The concentration of ozone (the quality) can be regulated by diluting it with air, or by changing the voltage with a rheostat. The quantity can be measured from time to time, by the well known chemical method with potassium iodine. The air can be measured with an air-flow meter. This machine is marketed by the Central Scientific Company of Chicago and not only has its advantages in the laboratory for practical determination for large water purification plants, but it can be applied in many other industries where bleaching or rapid oxidation is required.

WATER WORKS MAINTENANCE AND OPERATION

Practical Measures for Securing Greatest Economy in Public Utility Plant Operation

By Charles Brossmann, Consulting Engineer, Indianapolis, Indiana

IV.—Instruments and Their Uses

Thirty years ago eggs were 15c a dozen. Now they are becoming a luxury. Thirty years ago a Ford would have been a luxury. Now you can hardly do business without one. Thirty years ago we had hopes of the submarine. Now we hate the sight of them.

Thirty years ago 15 or 20 lbs. of coal per k.w. was common. Today we are doing it on 5 lbs. and less in well-operated plants, according to size. And then coal was costing from $1 to $2 per ton. Now it is $4 to $6 per ton.

And it all goes to show that things certainly do change.

But some things change oftener and more radically than others. Improvements in power machinery have been gradual, necessarily so, as it is not possible to discard equipment each year as a new idea is introduced. But many concerns find it pays to tear out the old and put in the new, even at great cost. In such cases the saving and convenience must warrant it.

Bad habits or methods of doing things are not so easily changed as equipment, and in many cases can be changed only by a hard jolt. There are some habits or methods that are receiving some hard jolts at the present time, and the main reason is that the pocketbook is badly jolted also.

War Sharpens the Wits

I'll venture to say there has been more hard thinking about fuel economy by some plant owners and managers in the last year than in the 30 years mentioned at the start of this article.

Things in the past have been too easy. The South Sea Islander does not think of his next meal, because he has only to climb a tree and get it. Neither was it hard to get coal 20 years ago, or even 5 years ago, but now—. And that is the reason we are now thinking of such things as CO_2, when 20 years ago you would have been laughed at with your little analyzer.

College professors and mathematicians discussed higher economics then. Now the operating engineer and manager has his own instruments if he is progressive, and he can tell you something about economics. But the trouble is that not enough men realize what can be done by application and thought to the things that we formerly thought were not essential.

Introducing a Rational System of Operation

What a God send it would be if your old boiler would spit like a gasoline carburetor when you gave it the wrong mixture of air. It would be a little trouble, of course, but you would no doubt see that things were changed. One great trouble is that in all these little leaks they can get by unnoticed so easily.

Now, system is a thing often overdone. It is also something that you can't do without in some cases and places, and I am going to touch again on the question of proper firing and say that you should work out your best system and follow it, even if it is some trouble. Get yourself a scale for weighing coal and some means for weighing water or a steam-flow recording instrument and start with these, and as you become more interested, and, what is more important, as you get results, keep trying. Start a simple boiler and engine room log and keep track of the main items at first, and add to it and revise as it is found best. When you get your scales, start on your firing and investigate and try for your best condition—make note of the time between firings and number of scoops of coal, and all items that affect it, and you will notice changes if there is a chance for improvement.

The Necessary Foundation

If you have a regular load, such as most water works plants have, you will find certain conditions best to get the most economy. Find your best thickness of fire. Fire one side at a time and try with 5 or 6 scoops of coal, taking one door at a time. Get some timing arrangement, a bell to ring every 5 minutes, or the time necessary to cover all boilers according to number. If more than one fireman is required, let one work while the other rests, firing alternately, first all right-hand doors, then all left-hand doors. This is just a suggestion if you have never tried it, but the more uniformly you feed your coal and air, the better will be the results of combustion. Now, with your scales to weigh coal and your boiler room log sheet, you have your first simple recording instrument and

the necessary foundation to start things. Try and follow with the others. If you have a recording feed-water meter or steam meter, it now becomes easy to get the comparative results of evaporation, and that is your main object at the boiler —to turn the greatest amount of steam into water. With your records and means to find out, you can try out for the best methods of firing and you will notice the difference.

Operating the Boiler

Your boiler is a regular patient; its temperature and digestion are changeable; its temperature is up and down. Hang a chart at the bedside—you are the doctor, and you will get results if you watch both your patient and chart.

Some men feed a boiler with water regularly, a little at a time; some will give a big dose of water and wonder why the power drops. You can feed in large, sudden quantities, and your load will be quickly affected. Feed the water as uniformly as possible. The same holds good for the air—and all in proper quantities.

Blow the tubes or surfaces for soot regularly. Get a thermometer, one that will register 800 to 1,000 degrees, and try your stack temperatures after soot blowing, and see if there is a difference, and find out how often you should blow. You want all the heat you can get into the boiler, not out the stack, and keep a record of when the tubes are blown, so you will know that you did not forget it.

The firemen should understand that the purpose of any meters, recording instruments and the proper keeping of records are not for the purpose of criticising his work, but that they are to assist him in saving fuel and making his labor lighter. He should realize what it means if his boiler plant is using, say, 20 tons a day. If he saves 10 per cent he will cut out the handling of over 700 tons of coal each year and a goodly number of tons of ashes will not have to be wheeled. Have your records made so that a copy can be kept at the plant as well as at the office, and if your plant is large enough to get up interest between shifts, have a blackboard so that each crew can see what is being accomplished. Get the right spirit into the men

Power Plant Economy No Longer Optional

Remember also that you will have to look into these things. The government is taking a hand, and federal inspection of plants is a definite thing. A systematic classification has been started and is now under way and plants will be classified according to their efficiency and care used in operation. The ratings will be divided into five classes. The first one to suffer in a fuel shortage will be the waster of fuel, so to operate your plant inefficiently may be the means of closing it, as the one wasting fuel will be the first to have coal refused when the pinch comes.

This does not mean that you must install new and expensive apparatus, but you should place what you have in good condition and then see that it is operated properly.

Your boilers may be in fine shape, but you may be firing wrong; the tubes may be sooted up, or your blow-off valves may leak.

Your engines may be O. K., but perhaps a valve needs adjusting or a steam trap may be leaking badly.

You may have a good feed water heater, but perhaps your water temperature is 150 degrees when it should be over 200 degrees. See if the inlet and overflow are leaking.

Your condenser and air pump to your engine may be of the best, but perhaps you are getting only 23 to 24 ins. of vacuum when you should have 26. Look into it and find the trouble. See if you have a loose stuffing box on the L. P. rod or air leaks in the line. A mighty small one will kill the vacuum. I once had a bucket full of crawdads and fish heads taken out of the tube sheet of a surface condenser and they had blamed it all on the circulating pump.

In one plant a new stack had been built higher than the old stack and the old stack had been left connected to the other end of the breeching. The new boiler would not carry the load and it was blamed on the boiler. A draft gage would have shown the trouble at once, even if the owner had not known better than to think the two stacks would give better draft.

Instruments Are Indispensable

But what is the lesson of all these things. Simply this: that you can't tell what you are doing without instruments. In some cases simple indicating instruments and in some cases recording instruments. Some are more or less complicated, but it is impossible to get along and save without a certain number of them, which will be determined according to your operating conditions. You have a gage on your boiler. Why not a thermometer to measure stack temperatures? Why not one to record feed water temperature? If your feed temperature is 180 degrees and should be 206 to 210, have you ever considered what it means if you have exhaust steam to spare? If you are burning 20 tons of coal a day and with coal at $4 per ton, it is close to $500 per year. You could buy several recording thermometers for that, and you don't even need a recording one if you will watch a simple indicating thermometer at intervals.

Take the steam flow meter, for instance. If you have more than one boiler, get a meter for each boiler. How do you know each boiler is taking its share of the load? The meter will show you instantly and your fireman will then know when something is wrong. How else can he know?

I have seen several boilers operated where one with a slight overload would carry the whole plant and at better efficiency.

Every plant with an engine or pump should have an engine indicator, but I have known men to have them and not use them once in a year.

Instruments must be used and used intelligently, and the time should be taken to use them. Employes should be instructed and encouraged to use them to advantage, and the owner or superintendent or manager should instruct his men and get the results. Give your men the encouragement to use the instruments. Don't expect maximum results with minimum means for obtaining them.

No man can obtain the best results in economy unless he has, first, the desire, and second, the equipment. And it will take some thought and some work, but you will get back a great deal more than you put in.

Herewith is given a list of some of the important instruments used in the modern plant for assistance in fuel saving and the proper keeping of records.

Some Instruments Used for Procuring and Maintaining Maximum Efficiency in Power Plants—What They Record or Indicate and Other Useful Things They Show

Record steam pressure gages: Give continuous record of steam pressure; indicate indirectly firing condition.

Recording water pressure gages (for water works stations): Give continuous record of water pressure; indicate indirectly water conditions and steam conditions.

Recording and totalizing water meters, revolution counters (water works stations): Give actual record of water consumption. Meter readings will assist in showing up losses and large leaks in mains. Show increased consumption. Used in connection with revolution counter on pump, it will show condition of water end of pump and assists in timing slip, etc.

Recording graphic watt meter, totalizing watt meter (stations using electric power): Gives total electric load or current consumed. Used in connection with fuel scales; coal per k.w. can be determined. Proper records should be kept so that pounds of coal per k.w. does not increase without means being taken to find the trouble. The graphic meter also shows the load at each instant of the day—gives the peak and shows up any unusual condition.

Thermometer, stack: Gives temperatures of gases in rear passes and stack. Increase of stack temperature above normal may indicate accumulation of soot on shell or tubes. Decrease below normal may indicate excess air or holes in fire or leaky settings, or, indirectly, too large grate surface.

Orsat apparatus, hand flue gas analyzer for CO2 (carbon dioxide) readings: Shows combustion conditions in furnace by gas analyses. This is a very essential and useful device, used mainly to build up furnace efficiency. Indicates condition of furnace efficiency. Shows excess air conditions (each 12 per cent excess air above 40 per cent means 1 per cent fuel loss). Indirectly indicates proper draft conditions—thickness of fires, etc. Shows if boiler setting is leaky—indicates holes in fire. Shows proper timing of firing.

CO2 automatic gas recorder: Gives a continuous record of gas and excess air conditions in furnace. This instrument used to maintain furnace efficiency after working up with hand apparatus mentioned above. Indicates for the entire day the condition under which furnace has operated and gives a complete record of whether boilers were fired efficiently. Fireman can watch instrument to see if he is getting results, and in this way it is of great service. Some instruments have a bell alarm which rings if furnace is not properly fired.

Feed-water meter, weigher and recorder: Gives evaporation of water in boilers. In connection with coal-weighing device, gives evaporation per pound of coal and is index of comparative efficiency of evaporation. Also gives index of value of different coals. With no change in fuel, but drop in evaporation, it shows that some part of boiler plant needs attention.

Draft gage, simple and differential gage, boiler efficiency meter: Gives draft conditions in furnace, boiler passes, breeching and stack. Used to equalize draft in each boiler. Assists in showing furnace conditions. Adjustment of stack or uptake dampers and ashpit doors. Shows loss through passes and locates ash and soot accumulations in tube passages. Assists in locating air leaks in settings. Assists in determining proper firing conditions.

Thermometer, feed-water, indicating and recording: Shows temperature of feed water. If there is surplus of exhaust steam and water temperature is too low, indicates heater out of order, water inlet valve leaking or too much waste in overflow. (Each 13 degrees difference in feed water temperature due to exhaust steam equals 1 per cent. of coal.)

Steam flow meter, recording and indicating: Gives quantity of water evaporated or steam generated. Used in connection with coal weighing devices, it gives evaporation of water per pound of coal. Indicates if each boiler is pulling its proper load, if attached to each boiler. Indicates improper feeding of water to boilers. Indicates formation of scale in boiler by showing drop in efficiency. Assists in showing such things as holes in fires and shows up firing conditions. Recording meters will record the amount of steam going to any part of the plant or individual unit, such as pumps or engines, and thereby indicate condition of units. Can be used for recording steam sold for heating or other service. Of value in stopping losses caused by leaks between boiler and other points, also indicates internal leaks, such as blow-off line, if the input to boiler is known.

The Performance of Fuel Oil Engines in Water Works Service

By S. N. Connally, Fisher Bldg., Chicago, Ill.

It has been a very interesting study to watch the changes made in pumping equipment in the course of the last few years—in the pump itself and the various methods of driving. We, who are familiar with pumping equipment, have seen, in the larger plants, the slow-speed crank and flywheel Corliss pumps, and in plants of moderate and small capacity, the Myer and slide-valve crank and flywheel types, and the old direct acting simplex and duplex pumps. In the larger plants the Corliss and Reidler valve pumps, compound and triple expansion, have their place, but even in these the centrifugal pump is slowly but surely taking its place, and in the moderate and small-size plants it has practically supplanted the above types, owing to smaller space occupied, consequently smaller buildings and real estate, although at the sacrifice of power saving.

The steam turbine and electric motor, owing to speed conditions, are well adapted to drive centrifugal pumps, but the objection holds that turbines are heavy on steam consumption unless running condensing and in large units. Also, induction motors, slip-ring and squirrel-cage types, and even the highly efficient synchronous motors, are an expensive method of drive, except in the case of very cheap current from water-power sources.

Type of Pump and Method of Driving

Triplex pumps are not well adapted to turbine or motor drive except with belts, and modern power and pumping plant practice demands direct connection or gear drive of high efficiency. The water works engineer, in these days of high fuel cost, is confronted with two problems, i. e., the type of pump he will select and the method of driving. He may select the centrifugal pump for several reasons, but will still be undecided whether to drive it with turbine, electric motor or oil engine. His first thoughts probably are: "The oil engine is too expensive in first cost," and he has a doubt as to its reliability. The oil engine will be more expensive in first cost

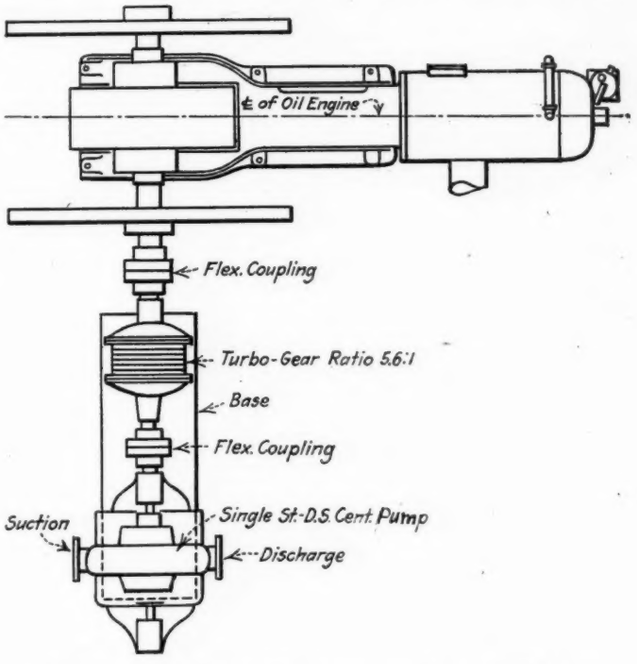


DIAGRAM OF INSTALLATION OF OIL ENGINE IN WATER PUMPING SERVICE WITH INTERNAL TYPE OF HERRINGBONE GEAR.

as compared with the electric motor, but not compared to steam pump or turbine, with its attendant boiler plant and large space required, because the oil engine is an entire power plant in itself.

As to reliability, there may have been a time when there was a question, but experience has made the modern oil engine a piece of apparatus which will meet the most exacting requirements.

We will not take into consideration in this article the true Diesel engine, owing to its extreme first cost, and the fact that it is built in only comparatively large units, but will consider the semi-Diesel oil engine of moderate compression,

which is moderate also in first cost and economical of fuel. There are several oil engines of this type on the market, both two and four-cycle, differing greatly in design and details. In general, the most dependable semi-Diesel oil engines on the market are those of the two-cycle type, simple in design and most accessible, and which employ crossheads instead of the trunk piston, have no valves, and the fewer moving parts the better. Both vertical and horizontal types are built, with the advantage in favor of the horizontal owing to ease of accessibility.

Assuming that the engineer has decided to use an oil engine to drive his centrifugal pump, he is naturally concerned as to the best method to use to adapt the speed of the oil engine to the pump. The best solution of this difficulty lies in the use of an internal type herringbone gear of high efficiency.

A New Oil Engine Pumping Unit

A line of water works pumping units has recently been placed on the market, which uses this type of gear increase between the oil engine and pump, as shown by the accompanying sketch.

This makes a very compact outfit, and is readily adapted to water works plants. The engineer is next interested as to the first cost of pumping plants.

Operating Costs

Without going into exhaustive engineering detail, it can be stated that the turbine pumping plant, with its turbines, pumps, boilers, piping, feed-water heaters, condensers, feed pumps, etc., will be high. The oil engine plant, with its oil engines, pumps, fuel tanks, circulating pumps, oil pumps, starting apparatus, next, and the electric plant, with its pumps, motors and starting equipment, low. Next he considers depreciation. Let us allow for this 5 per cent. per annum for the steam plant, 5 per cent. per annum for the electric and 10 per cent. for the oil engine driven equipment. Then we will consider the cost of attendance. The steam plant will require one engineer at $125 per month and one fireman at $75. The electric plant, attendance at $100 per month and the oil engine plant $100 per month. For cost of fuel, we will assume a concrete example, i. e., a pumping plant of 1,000 g.p.m. capacity against a total head of 200 ft. A centrifugal pump of this capacity, operating at 65 per cent. efficiency, will require about 77 b.h.p. The nearest commercial turbine is 80 h.p.; electric motor, 90 h.p.; oil engine, 80 h.p.

Cost of coal for steam turbine condensing, 10-hr. run; coal, $5.50 ton.....$16.50

Cost of current for electric motor, 10-hr. run; 3c per k.w. hr. 16.50

Cost of fuel for oil engine, 10-hr. run; fuel oil, 7c gal... 7.00

On a 300-day run, the saving on fuel cost by operating the oil engine would be $2,850.

Assuming, as above, that steam equipment life is 20 years, electric equipment life is 20 years, oil engine equipment life is 10 years, and taking the cost of an 80-h.p. fuel oil engine as $6,000, the saving in fuel alone would practically equal the first cost of the engine in two years.

Testing a Well Under Difficulties by Unusual Methods

By W. G. Kirchoffer, Sanitary and Hydraulic Engineer, Madison, Wis.

The city of Hartford, Wis., has an abandoned 10-in. well at the City Hall which they desired to use to increase the water supply for the city. The well was drilled many years ago, but was abandoned by the drillers before the contract was completed. The well was reported to be 893 ft. deep, but had never been tested for capacity. The records show that they drilled through 40 ft. of St. Peter sandstone. This amount of water-bearing rock, if of same capacity as the average sand rock in Wisconsin, should yield 80 gals. per minute with a lowering of 50 ft. The static water level was 25 ft. from top of casing.

Water Test

A preliminary test was made by filling the casing to overflowing from a fire hose near by and then noting the time required for the water to recede at each foot from the top. Table No. 1 is a record of this test.

TABLE I—RECORD OF PRELIMINARY WATER TEST

Size of casing, 10 ins.; capacity per foot, 4.08 gals.
Top of casing to water before filling, 25 ft.

Distance from top of casing to water, in feet.	Time required for water to recede to depth given in first column.
0	0
1	8 sec.
2	20 sec.
3	30 sec.
4	46 sec.
5	1 min. 5 sec.
6	1 min. 25 sec.
7	1 min. 48 sec.
8	2 min. 22 sec.
9	2 min. 35 sec.

The drop in the first few feet was accelerated, due to the velocity of the inflowing water from the hose attached to the discharge of an 8x10-in. triplex pump. The drop is fairly uniform after a depth of 4 ft. is reached. The test would indicate that if this method of testing a well was to be relied upon, the capacity should not be based upon the lowering in the first few feet.

This data would indicate that a supply of about 1 gal. per foot of lowering per minute could be obtained. Some of the city fathers doubted the correctness of the theory that a well will take as much water as it will yield under a given lowering and requested that a pumping test be made. No deep well pump nor power was at hand with which to make such a test, and it was useless to attempt a test by direct suction.

Air Test

At the power station of the city water and light plant there was an air compressor raising water from a 12-in. well. This compressor was a 6½x10x10-in., operating at 225 r.p.m., and delivering 203 cu. ft. of free air. It was suggested that air could be carried by means of 2½-in. fire hose from the compressor to the well, for the purpose of testing. This was done; the line was 800 ft. long, with 357 ft. of 1-in. air pipe in the well. An inserted casing for the discharge of the water should have been placed in the well, but as none was at hand, the well casing was used as a discharge pipe. A pressure gage was placed at each end of the line. Table II is a record of the test:

TABLE II—RECORD OF AIR TEST

Volume of free air (compressor displacement)	203 cu. ft.
Distance from compressor to well	800 ft.
Length of air pipe in well	357 ft.
Static lift	32 ft.
Static submergence	323½ ft.
Air pressure to start flow (both ends)	140 lbs.
Air pressure at compressor during flow	100 lbs.
Air pressure at well during flow	85 lbs.
Loss of pressure in 800 ft. of hose	15 lbs.
Time of discharge	35 sec.
Interval between discharges	3½ min.
Total period of discharge about	4 min.
In which time was delivered	200 gals.
Discharge per minute (about)	50 gals.

It required 140 lbs. to start the air lift. This was noted at both ends of the line. As soon as the water started, the pressure at the station dropped to 100 lbs. and 85 lbs. at the well, a loss of 15 lbs. at that initial pressure.

It is of interest to compare this loss with that given in table for friction loss in 2½-in. pipe when discharging 200 cu. ft. of air under 100 lbs. pressure. Bulletin 58L of the Sulli-

van Machinery Co., of Chicago, gives a table of such a loss, and for the conditions named it would be 1.12 lbs. for 100 lbs. pressure and 1.28 lbs. for 85 lbs. pressure. The volume of air at 100 lbs. is 25.62 cu. ft. and at 85 lbs. is 29.48 cu. ft. The same volumes of water discharged through 800 ft. of 2½-in. hose would show a loss of head of 82 lbs. and 98½ lbs., respectively. (Weston's tables.)

Owing to the small capacity of the well and the large discharge pipe, the flow was very intermittent, but, as given in table, about every 4 minutes 200 gals. would be discharged. The lowering of the water could not be measured, but from the drop in pressure it must have been 126 ft. during the 35 seconds of discharge.

This demonstration fully convinced the city fathers that the capacity of the well was too small to be considered as an effective aid to the city water supply.

FROM WORKERS IN FIELD AND OFFICE

Stone Spreader a Money Saver

To the Editor: Richland County, Ohio, owns two Burch (Burch Plow Works, Crestline, Ohio,) stone spreaders and their use has resulted in a substantial saving of labor and money. The data here given are based on our daily haul of 240 tons of crushed stone on I. C. H. No. 202 Sec. B, Mansfield-Galion road.

Before the spreader was used on this work we hauled with trucks, and this required five men on the dump at 35 cts. per hour, making an expense for an 8-hour day of $14 for spreading. Since placing the spreader in operation we have

BURCH STONE SPREADER IN OPERATION.

one man on the dump at 35 cts. per hour, making an expense for an 8-hour day of $2.80 for spreading. This means a saving of $11.20 per day on spreading, due to the use of the spreader.

The original cost of the spreader was $160, and as repairs, etc., are almost a minus quantity, the spreader pays for itself in less than 15 days.

Very truly yours,

BOYD WIERMAN,

Mansfield, Ohio, Aug. 13, 1918. County Surveyor.

Removing Silt from Irrigation Reservoir with Dragline Excavator

TO THE EDITOR: The greatest problem we have to meet in this country in the storage of water for irrigation purposes is the disposal of the silt which the water carries in suspension in flood times. Allowing this to accumulate in any reservoir would in a short time destroy the capacity of the reservoir.

We attempted to meet this problem a few years ago, by running all of the water intended for storage purposes through an auxiliary reservoir, which we called our settling basin, where the water was stilled and the silt settled out. This worked admirably for a period of years. But all too quickly this auxiliary reservoir became entirely filled with silt, supplying, therefore, no more settling capacity.

It was then, this spring, that we installed our Sauerman (Sauerman Brothers, Chicago) ½ cu. yd. levee type outfit, operated by a 50 HP Westman engine, and a Lidgewood hoist. With this outfit the silt has been handled in splendid shape.

We might add, that it is practically impossible to remove this silt with teams and any kind of scrapers. We attempted this one season after the settling basin had not been used for several months in the summer, and it was apparently well dried out. We found, however, that as soon as the top crust was removed, the silt was so wet and mucky underneath that it would not hold up a man, much less a team pulling a scraper.

The excavator under our conditions with a half yard bucket, handles very comfortably 125 to 150 yds. a day. We have operated such a brief time that we have not as yet complete cost figures, though we will be able to give these at the close of the season. In fuel consumption the engine is very economical.

Very truly yours,

THE GARMESA ORCHARDS CO.,

By Robert W. Lazear.

Fruita, Colo., Aug. 9, 1918.

REMOVING SILT FROM IRRIGATION RESERVOIR WITH SAUERMAN ½ YD., LEVER TYPE, DRAGLINE OUTFIT.
Bucket on Cable at Beginning of Work. Bucket Dumping at Base of Mast Back of Reservoir Dam. Appearance of Pit After Two Months of Work, Approximately 200x75 ft. by 20 ft. Deep.

Sprinkling Filter System and Auxiliaries vs. the Activated Sludge Process

To the Editor: Mr. T. Chalkley Hatton has done well to emphasize the protection that should be afforded riparian owners and others liable to annoyance or damage from the presence of sewage disposal plants or their effluents, irrespective of economical consideration. Consideration is due to their point of view as a matter of justice, and it is to be hoped that this broader and more human aspect of the question will be more generally held in the future than heretofore. *The general welfare and happiness of the community* should be the end sought, not the mere saving of dollars and cents by the transgressor.

It is perhaps a little early to pass judgment on the relative merits of trickling filter and activated sludge plants, but this is a matter that sanitary engineers are eager to have cleared up and Mr. Hatton's article marks an important step in this direction. Most of his claims for activated sludge will hardly be questioned, but there will probably be a difference of opinion as to the last three advantages mentioned: Disposal of Sludge, Cost of Plant, and Cost of Operation.

The activated sludge process is somewhat elaborate, and if the large volume of sludge is not promptly dewatered there is the grave possibility of odor. This, of course, may occur with any kind of treatment, but with a greater resulting nuisance with activated sludge than with a somewhat inferior Imhoff sludge. Moreover, the relatively small volume and lack of offensive odor in well-digested sludge will permit its transportation and exposure on drying beds.

The operation of dewatering activated sludge appears to be in the way of successful solution either by presses or centrifugals and heat drivers, but the writer is "from Missouri" and awaits more complete information than is now available from the few briefly-operated plants now in existence, before forming a general opinion.

And the same may be said as regards cost. This will necessarily vary materially with the character of the sewage, the local labor market and the price of fuel and power. In New York City, for instance, power would cost about twice as much as at Houston, which places the matter on quite a different footing. It would appear that in some of these respects the city of Houston may have had the advantage of Fitchburg and Gloversville. And changing war conditions may also alter existing relations materially.

The relative economy of the activated sludge as compared with other processes depends very largely on the sale of fertilizer. Activated sludge has been shown to have a very considerable value in this respect, as stated by Mr. Hatton, and even if only the cost of dewatering is covered in this way it is a great point gained, as this seems to be an essential concomitant to successful operation.

Personally, the writer believes a comparison of cost between the two methods is liable to be misleading without pretty full knowledge of, and allowance for, local conditions, and this will in the main account for the apparent discrepancy between the figures of Mr. Eddy and those of Mr. Hatton.

As far as the public is concerned, the activated sludge process has not yet emerged from the experimental stage—in particular regarding tank design, aeration and dewatering—and possesses little definite data from operative plants if we omit those furnished by the admirable installation at Milwaukee. Under favorable conditions, however, the writer believes that the activated sludge process has a useful future and that to Mr. Hatton and his chemist, Mr. Copeland, credit should be given for its successful development in this country.

Very truly yours,

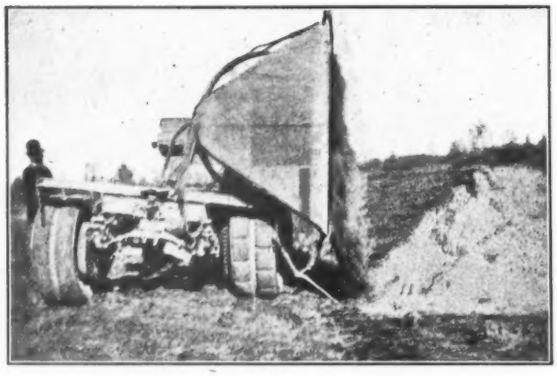
KENNETH ALLEN, Sanitary Engineer.

Board of Estimate and Apportionment,
New York City, N. Y.

PLANT UNITS AND LAY OUTS

A Side Dump Body for Motor Trucks and Trailers

Reduced delivery cost on all bulk materials is secured by the use of the Winsor gravity side dump body here illustrated. If a trailer is used the truck load can be discharged without



WINSOR GRAVITY 6-YARD DUMP BODY ON 5-TON TRUCK DUMPING 5 YDS. OF GRAVEL.

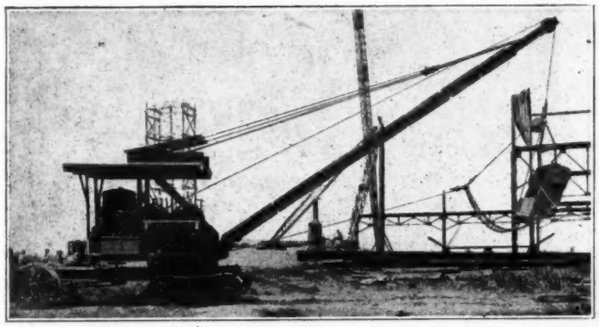
disconnecting the truck from its trailer. The load can be discharged to either side and clear of the wheels. No power is required to operate the dump body and it has no mechanical parts to get out of repair. After discharging by gravity the body returns to an upright position by gravity and automatically locks. The bodies are quickly removed, making way for loads of lumber, structural steel, etc. The Department of Public Works of Detroit has, in its asphalt repairs section, a Dodge roadster equipped with a Winsor 1 cu. yd. gravity dump body that is insulated with asbestos. On the statement of A. C. Proctor, asphalt expert of the department, this outfit performs the work of three teams at an expense of $7.50 per 10-hour day. The bodies are made by the Winsor Gravity Dump Body Co., Inc., Detroit, Mich.

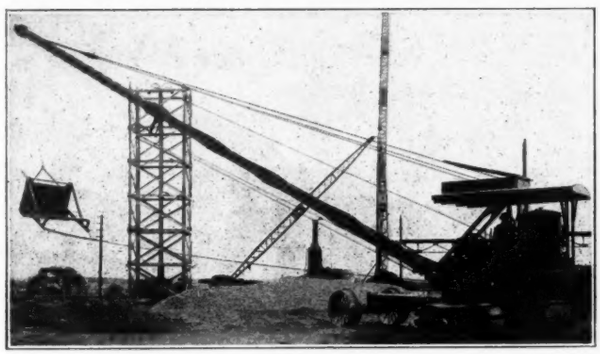
A Portable Corduroy Traction Drag-Line Excavator for General Use

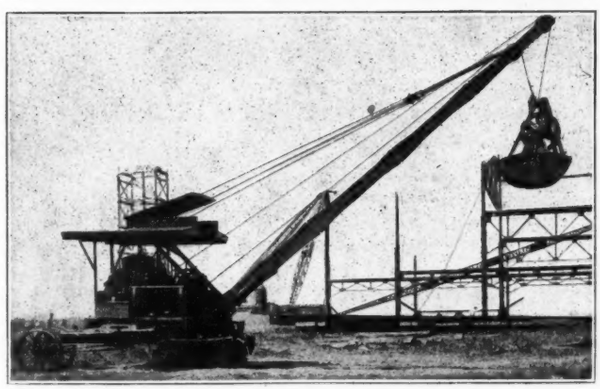
A portable corduroy traction drag-line excavator, weighing but 13 tons, for backfilling, for general drag-line work and for handling material with a ½-cu.yd. clam-shell bucket, has been perfected by the Pawling & Harnischfeger Co., of Milwaukee. The machine is here illustrated. For backfilling it can be used with a 30, 40 or 50-ft. boom and the P. & H. ½-yd. self-acting scraper bucket. It is suitable for digging irrigation and drainage ditches. This machine is also used to advantage as a portable locomotive crane. When equipped with a clam-shell it is used for loading or unloading screenings,

crushed rock, sand and gravel, or any other work requiring the use of a clam-shell bucket. With this machine the contractor can also unload heavy sections of cast iron, vitrified clay and concrete pipe from cars to trucks and from trucks to trench. The machine will also pull sheet piling. The machine is built of the highest grade material throughout. The gears are made of either steel castings or steel forgings, and all the high-speed spur-gears have teeth cut from the solid.

The under-frame is built up of structural material and is supported at one end by a pair of corduroy tractions, each 18 ins. wide and 4 ft. 9¾ ins. long from center to center of end sprocket shafts, and at the other end by a pair of traction







VIEWS OF NEW PAWLING & HARNISCHFEGER PORTABLE CORDUROY TRACTION DRAG-LINE EXCAVATOR, AS EQUIPPED FOR DRAG-LINE, BACK-FILLING AND CLAM-SHELL WORK.

wheels 38 ins. diameter by 16 ins. face, mounted on an axle which is pivoted for steering.

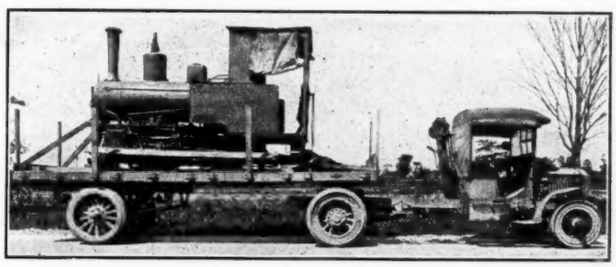
The corduroy grip tractions are driven by means of gearing from a propelling shaft extending across the under side of the under frame. Seven-inch ship channels, 18 ins. long, securely riveted to the link castings, form the tread of the corduroy. Self-adjusting rollers are provided between the end sprockets for transferring the weight of the machine to the ground. The general design of these tractions is such that they can easily be dismantled for repairs.

The revolving frame consists of a heavy semi-steel center casting with structural steel side and cross-members, reinforced to stand swinging strains. The machinery is driven by a four-cylinder, 30-h.p. vertical motor of the internal combustion type. The revolving frame is rotated by means of a train of gears between the jackshaft and the swinging gear bolted to the top of the under frame. A 12-in. diameter drum driven from the digging shaft is provided for hoisting and lowering the boom. Operating levers and brakes are concentrated at the right side of the machine, giving the operator a full view of the work, and making one-man operation possible.

The machine appeals strongly to the contractor because of its universal application and its economical operation.

Semi-Trailer Solves Transportation Problem for Road Commissioners

The difficulties encountered by the road commissioners of Wayne county, Michigan, in securing freight cars for the transportation of material and equipment to the different parts of the county where road building work is going on, forced them to adopt a truck and trailer unit which is giving satisfactory service. From their base at Wayne they are compelled to haul supplies and equipment to the most remote sections of



HAULING 10-TON INDUSTRIAL LOCOMOTIVE ON 10-TON FRUEHAUF SEMI-TRAILER WITH 4-TON TRUCK, WAYNE COUNTY, MICHIGAN.

the country and are often rushed to keep supplied the several crews of road workers. The varied nature of these supplies and the long hauls presented a problem that is complex.

By using a 10-ton Fruehauf semi-trailer in connection with a 4-ton truck, they were able to cope with the situation and place themselves in a position to be independent of all other methods of transportation.

Hauling an industrial locomotive by motor truck seems a little bit out of the ordinary, but it is a possibility nevertheless. The 10-ton locomotive is one of several used about the county.

A Truck, Car and Stump Puller

The Sasgen truck car and stump puller, illustrated herewith, is built of crucible steel. The handle has a compound motion. The drum can be released in an instant by raising the lower dogs against the upper and pushing the lever back. The puller is anchored by three steel stakes which are connected to one another by a chain. For pulling cars the puller

THE SASGEN TRUCK CAR AND STUMP PULLER.

is hitched with a chain to a rail. The puller is strong enough to pull small stumps. It is also handy to place on a truck body to pull heavy loads onto the truck. It is manufactured by the Sasgen Derrick Co., of Chicago.

A Drag-Line and Clam-Shell Bucket Machine with Attachments

The Austin drag-line with 18-ft. combination boom, 11-ft. "bite" and ½-yd. skimmer scoop, and guided draw dipper for shallow work, road and park improvement work, grading and trench work, is here illustrated. This boom equipment is an attachment to the Austin drag-line with multi-pedal traction. A boom suitable for adjustable dipper of the standard shovel type can also be secured. For long-range backfilling a special 50-ft. boom can be used.

The standard boom with this drag-line and clam-shell bucket machine is 30 ft. long. This excavator is constructed of three units: the lower frame or sub-structure, the upper frame or superstructure, and the boom and bucket. These parts, as assembled, form a complete operating machine for excavating earth, trench digging, street grading and wagon loading, railroad ditching, handling coal, sand, gravel, crushed stone or other similar materials. For operating or transporting purposes the excavator is mounted on multi-pedal traction, capable of moving forward or backward or turning at any angle in either direction. The power plant consists of a vertical type, heavy duty engine, operated by either gasoline, kerosene or distillate. The machine is manufactured by the F. C. Austin Co., Inc., Chicago, and is fully described in Bulletin No. 106.

AUSTIN DRAG-LINE AND CLAM-SHELL BUCKET MACHINE, EQUIPPED WITH SKIMMER SCOOP ATTACHMENT.

Blasters' Handbook

A pocket text book called the Blasters' Handbook, has just been issued by E. I. du Pont de Nemours & Company, of Wilmington, Del., which tells in detail how to blow soot from big chimneys, how to break up old boilers and heavy machinery, and how to use explosives for every purpose where their employment is practicable. This book gives valuable information regarding the proper explosive to use, the quantity, the method of loading and firing. It is well illustrated and contains charts and diagrams that make this work a valuable addition to any technical library.

A Motor-Operated Surfacing Machine

To meet the demands for a surfacing machine suitable for small jobs and the repair and maintenance of tile, marble, granolithic and composition floors, the Cavicchi Polishing Machinery Company, of Quincy, Mass., has developed a one-man type operated by an electric motor.

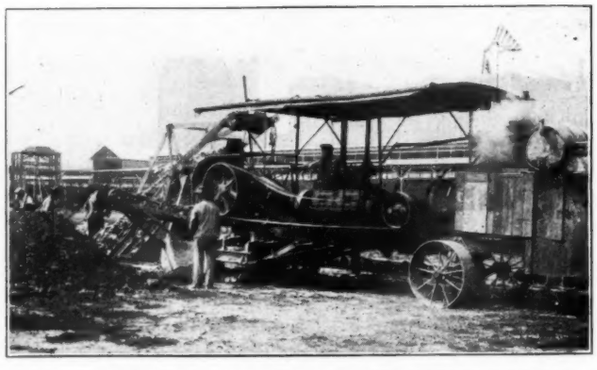
It can finish flush with the walls and owing to the construction of the surfacing wheel can be used on irregular surfaces. This wheel is composed of concentric segments which revolve independently of each other, to which the grinding blocks are attached. These blocks are 2⅛ in. high and wear to ⅜ in., when they can be easily replaced.

SURFACING MACHINE FOR REPAIR AND MAINTENANCE OF FLOORS.

Practically the entire weight of the machine is located directly over the grinding surfaces. Operation and speed control are regulated by the switch and rheostat located on the handle of the machine. The surfacing wheels are actuated by a fractional (¾) horse power motor, made by the General Electric Company for the prevailing current which can be taken from a convenient socket.

Austin Trenching Machine on Rush Job

An unusual rush sewer job was occasioned by the necessity of providing temporary sanitary facilities for the U. S. Government War Exposition, which opened in Grant Park, Chicago, September 2. The contract, which was turned over by the South Park Commissioners to the Chicago Drainage Construction Company, called for the laying of approximately 3,600 ft. of 8-in. pipe. The digging was particularly difficult,

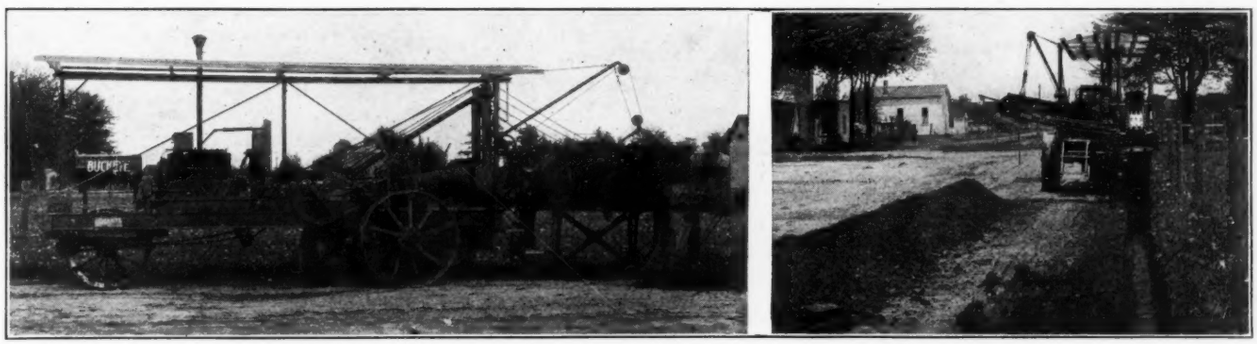


AUSTIN MACHINE EXCAVATING SEWER TRENCH FOR CHICAGO WAR EXPOSITION.

as Grant Park is mostly made land, full of boulders and other obstructions. The use of an Austin trenching machine enabled the contractor to handle the work within the short time-limit allowed, in spite of the different excavating conditions. The best day's record was 400 ft. of pipe laid.

A Curb Line Excavator

The curb digger here illustrated is manufactured by the Buckeye Traction Ditcher Co., Findlay, Ohio, and is built along the same general lines as the trench excavator manufactured by the same company, with the exception that the wheel is offset to one side. This construction makes possible the machine digging of curb trenches from 12 to 36 ins. wide and from 3 to 4 ft. deep, depending on the size of the machine. The No. 1 will dig 12 or 18 ins. wide by 3 ft. deep; No. 4, 18 or 24 ins. wide by 4 ft. deep, and the No. 4-A, 24 or 36 ins. wide by 4 ft. deep. It has a cutting speed of from 2 to 8 ft. per minute for the small machines and from 3 to 12 ft. per minute for the large machines. The equipment is driven by a 4-cylinder, heavy-duty, slow-speed motor. It has a road speed of 1¼ miles per hour. On contracts of any size road and street paving contractors will find this machine a money-saver.



SIDE AND END VIEWS OF BUCKEYE CURB TRENCH EXCAVATOR.

Successful Application of Tractor on Heavy Road Grading

Recently the county highway commissioners at Grand Forks, North Dakota, conducted a demonstration of the capabilities of tractors on road work. The Lanson tractor participated in this demonstration and performed, it is claimed, to the satisfaction of the commissioners. This tractor, at the demonstration, pulled a giant road grader, cutting a berm in virgin sod on a crown of 6% without any side draft. This performance was continued for eight hours without heating the water in the radiator.

The tractor, equipped with a fly-wheel, is adapted also for driving a stone-crusher and other types of machinery used on road construction. The tractor is equipped with a patented gear set locking device which prevents a careless operator stripping the gears. It is made by the John Lauson Manufacturing Co., New Holstein, Wis.

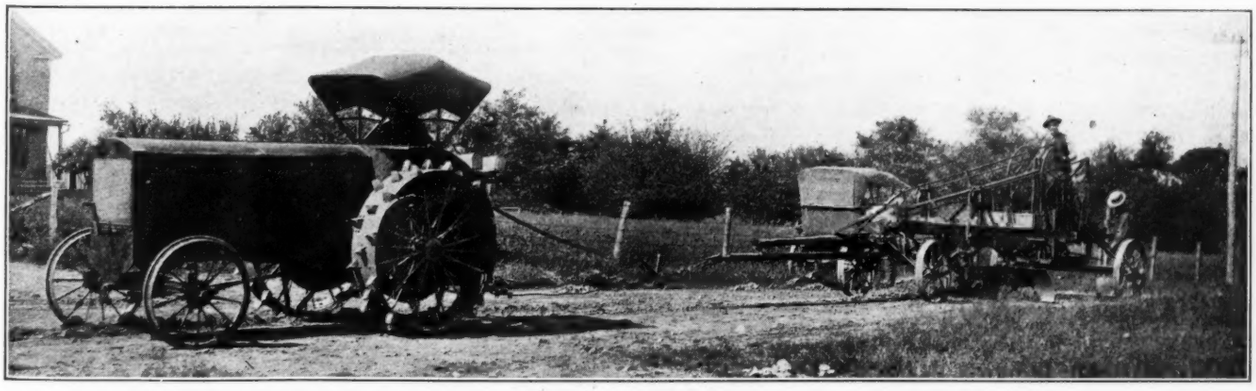
The Jarmin Gravel Loader

The Jarmin gravel loader is essentially a portable machine, and was especially designed to handle sand, gravel or other similar material at a minimum of expense. Many of these loaders are in use throughout the Northwest, especially by counties and contractors. Some of the counties have several of these loaders for use in different sections where gravel for road work is available. The loader is manufactured by the Spokane Culvert and Tank Company, Spokane, Wash.

The economy effected by using these machines is considerable, some of the costs being as low as 7c per yard. In no instance has the cost exceeded 10c per yard when sufficient material is delivered to the machine. One man only is required to operate the loader itself, and one or more men to deliver material to it by means of fresno, drag-line scraper or other equipment, according to local conditions. Usually one man with team and fresno is sufficient to load as much gravel as the teams will be able to distribute on the road.

The elevator and engine are mounted on a steel channel frame. The elevator can be lowered easily when it is desired to move the machine. The engine is either 6 or 8-h.p., to suit the work to be done. Sometimes a revolving screen is used in connection with the loader and is operated by it.

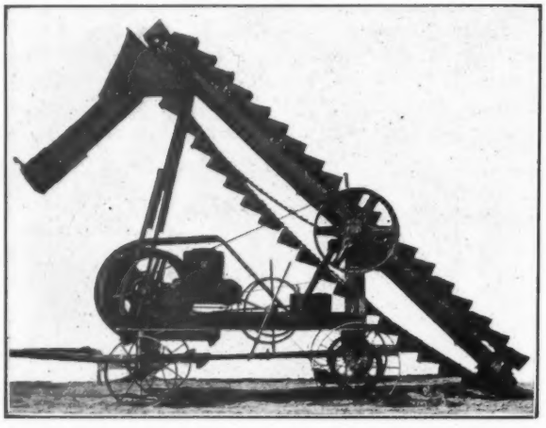
This loader is made in two types. One of these types is with digger buckets equipped with cutting edges of high carbon steel, to take the wear in scooping up loose gravel, sand or other loose material from the ground level, the machine being moved forward as necessary to a new supply of material by means of a hand moving device. These extra lips or edges are, of course, renewable as may be necessary, though they



LAUSON TRACTOR PULLING ROAD GRADER AT GRAND FORKS, N. D., TRACTOR DEMONSTRATION.

will last a long time in ordinary service. With this type the gravel is loaded directly into wagons or trucks.

The other type is made to load from below the ground level. In this case a hopper is installed at the lower end of the elevator, the top of the hopper coming even with the surface of the ground. Over this hopper a platform is built of plank, with a hole cut through the same size as the opening



VIEW OF JARMIN GRAVEL LOADER.

in the hopper, thus permitting driving across the platform and dumping into the hopper through this hole. In using this type the material may be loaded either into bunkers or directly into wagons or trucks, and the loaders may be moved to a new location from time to time, as may be necessary, according to the supply of material available.

The machine, it is claimed, will load from 30 to 50 or 60 yds. per hour, if sufficient material is brought to it.

PERSONAL ITEMS

C. E. Drayer, of Cleveland, Ohio, has been engaged by the Board of Directors of the American Association of Engineers to serve as national secretary. Mr. Drayer has been actively engaged in engineering society work of a local and national character for the past eight years. After graduating from college in Cleveland, Ohio, he served on western railroads until 1910, when he returned to Cleveland to become field engineer for the Nickel Plate Railroad on grade elimination work. He immediately joined the Cleveland Engineering Society and, as opportunity offered, took measures to advance the engineer in public esteem and to encourage him to train himself to be a leader in service to the community. After two years of marked success in the local society in Cleveland, he began to carry the message of progress to other societies and in time addressed most of the engineering organizations east of the Mississippi. In 1915 he became associated with Dr. F. H. Newell in forming the Committee on Engineering Cooperation of which he is secretary. He organized and is secretary of the Ohio Association of Technical Societies. He is co-editor of "Engineering as a Career," a series of articles of advice to young men. For several years he was editorial correspondent for "Engineering News" and "Engineering News Record," where most of his articles on engineering society organizations have appeared. He served the Cleveland Engineering society as its secretary for two years, and was a member of its executive board when elected secretary of the American Association of Engineers. He formulated the plan of combining the membership of the American Association of Engineers and Cleveland Engineering Society which promises to have a profound influence on engineering organization.

Bertram Brewer, formerly City Engineer, Superintendent of Water Works and Sewers at Waltham, Mass., is now with the engineering department of the Massachusetts Department of Health with headquarters in Boston.

Chester G. Wigley has resigned as Chief of the Bureau of Engineering of the New Jersey State Department of Health, to become associated with the engineering staff of Wallace & Tiernan Co., Inc., manufacturers of Chlorine Control Apparatus and Sanitary Engineering Specialties, with headquarters at 137 Centre Street, New York, N. Y.

John W. Toyne, engineer, 457 Farmers Trust Bldg., South Bend, Ind., has been commissioned a captain in the Quartermaster's Corps, U. S. Army, and assigned to Camp Custer, Battle Creek, Mich. For several years Mr. Toyne was superintendent of water works at South Bend.

H. M. Freeburn has resigned as assistant engineer of the Pennsylvania State Department of Health, to become associated with the engineering staff of Wallace & Tiernan Company, Inc., manufacturers of chlorine control apparatus and sanitary engineering specialties. Following his graduation from the sanitary engineering course of the Pennsylvania State College, Mr. Freeburn was an instructor at the institution and was in charge of experimental sewage work. Subsequent to this he was associated with the engineering branch of the Pennsylvania State Health Department.

Prescott G. Brown, captain of engineers, National Army, announces that the consulting engineering business of Mason L. Brown & Son, will be conducted under the same name by Prescott G. Brown as the successor. Mason L. Brown died on July 6, 1918. The business will be carried on the same as before with the same staff of engineers and assistants, and the office mentioned as heretofore at 819-824 Chamber of Commerce Bldg., Detroit, Mich.

Ossian E. Carr, of Niagara Falls, N. Y., has accepted the position of city manager of Springfield, Ohio, at an annual salary of $6,000.

Charles Brqssmann, consulting engineer, Merchants Bank Bldg., Indianapolis, and Frank C. Wagner, professor of Mechanical engineering, Rcse Polytechnic Institute, Terre Haute, Ind., have been appointed by the United States Fuel Admistration to take charge of special fuel conservation activities in Indiana industries. Mr. Brossmann's duties will be limited to investigation of electric power plants in the state for the purpose of making recommendations for the consolidation of certain plants in order to save fuel. The plants that will come under his observation will be public service electric plants, electric railway power substations and small power plants in other industries. Where it is found that current can be obtained from another source with a saving of fuel, recommendation will be made for closing the plant or consolidating it with another. For many years Mr. Brossman has been identified with large engineering projects. For ten years he has been secretary of the Indiana Engineering Society.

George M. Zimmerman, who tendered his resignation as city manager of Sandusky, Ohio, effective August 1, reconsidered and decided to remain when the city commission increased his salary from $3,600 to $5,000 a year.

Catalog Review

Housing—"Permanent Homes Make Permanent Workers," issued by Truscon Steel Co., Youngstown, Ohio. 8½x11 ins.; 16 pages. An exposition of the advantages of stucco on metal lath construction for industrial housing. The pamphlet is well illustrated and gives ample descriptive matter and detail. The particular advantages of Hy-Rib Metal Lath are clearly shown.

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This photograph shows the vanguard of a fleet of 142 U.S.A. motor-trucks entering New York over Riverside Drive. They drove all the way from Buffalo and are bound for the front.

It is estimated that at least 300,000 new motor-trucks will take to the roads during 1918. Many thousands of these will be army-trucks, which are expected to run from mid-Western factories 2,000 miles to the seaboard.

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(*Photo courtesy N. Y. World*)

CONTRACT NEWS

CONTRACTS AWARDED

ROADS AND STREETS

Ala., Florence—Southern Bitulithic Co., Nashville, Tenn., awarded contract by city to pave Court St., at $175,000.

Ark., Lewisville—Taylor Constr. Co., Texarkana, award. contr. for bldg. hwy. through Lafayette Co., at $126,000.

Ark., Little Rock—Mobley Constr. Co., 104 E. 2nd St., award. contr. for paving Pike Ave. (conc.), at abt. $32,000.

Cal., Exeter—Federal Constr. Co., San Francisco, contr. for paving several streets, at $111,000.

Cal., Los Angeles—Fred Hoffman, 111 E. 12th St., Long Beach, award. contract for constructing 5.92 mi. disintegrated granite rd.—Lancaster east toward Redman townsite in Rd. Impvt. Distr. 141, Antelope Valley, at $50,000.

Cal., St. Andreas—M. Blumenkranz, Stockton, award. contr. for constr. 9 mi. of road. Calaveras Co., at $46,494.

Cal., San Francisco—F. C. McIntire, Stockton, award. contr. for constr. of 9.7 mi. state hwy. betw. Valley Springs and easterly bound. Calaveras Co., at $46,494; J. P. Moffitt, City, award. contr. for constr. of 15 mi. state hwy. in Lassen Co.—Susanville to Coppervale—at $72,296.

Cal., S. San Francisco—C. J. Lindgren, Hillsborough, award. contr. for grading and constructing conc. curbs, walks, gutters and tract of South San Francisco Land & Improvt. Co., at abt. $13,000.

Cal., San Bernardino—Johnson-Shea Co., Riverside, award. contr. for constructing 3 miles of conc. road in Improvement Distr. No. 4, at $85,000.

Cal., Santa Barbara—Fairchild-Gilmore-Wilton Co., Los Angeles, award. contract for paving Montecito St.—State to Milpas—at $42,228; also Canal St.—Micheltorena to Valerio St., also Arrellaga St.—Canal St. to the Pueblo line—at $12,731.

Cal., Susanville—J. P. Moffitt, San Francisco, award. contr. for constr. of 15-mile sec. of road connecting this place with Coppervale, at $72,290.

Cal., Ventura—Fairchild-Gilmore-Wilton Co., Los Angeles, award. contr. for paving Main St. and Ventura Ave., at $29,806.

Cal., Ventura—Fairchild-Gilmore-Wilton Co., Los Angeles, award. contr. for paving 2 miles of streets through city of Fillmore, at $43,292.

Colo., Brighton—A. F. Hewitt, 1250 Pearl St., Denver, award. contr. for grading & hard-surfacing 1.7 miles Brighton Rd., 26 ft. wide, at $39,440.

Conn., New Haven—Franklin Contg. Co., 52 Vanderbilt St., New York City, award. contr. for grading Mechanic St.—Edwards to Willow St.; also resurfacing Edwards St.—Quinnipac Ave.—Clifton to Foxon Rd., to C. W. Blakeslee & Sons, Waverly St., at $16,996, $18,916 and $28,827, respect.

Ida., Grangeville—J. B. McCully, Nezperce, award. contr. for grading and surfacing with macad. 4.25 miles of road, at approx. $48,000.

Ill., Amboy—Hart & Page, Rockford, award. contr. for improving 4½ mi. Meridian hwy., Winnebago Co., at $66,066.

Ill., Chicago Heights—Chicago Heights Coal Co. award. contr. for paving in Dist. No. 2, at $87,410.

Ill., Decatur—S. A. Tuttle, local, award. contr. for paving N. & S. Park St.—Water to Franklin—portion of Prairie St., and E. Main, at $80,568.

Ill., Edwardsville—J. Kesl, award. contr. for paving Ellis St. with vitrified brick at $13,400.

Ind., Rochester—Jno. M. Hatch, Macy, Ind., award. contr. for constructing 2 gravel rds. in Rochester & Henry Twps., at $14,986 and $8,872, respectively.

Ind., Rochester—David B. Clevenger award. contr. for brick rd., in Rochester County, at $22,964.

Ia., Sioux City—Byers & Olson, St. Joseph, Mo., awarded contract by Board of County Supervisors for building Division No. 1 of Federal Road in Woodbury County from end of pavement on Correctionville Road through Moville and Correctionville to East County line, at $63,000. Contract for the third section which runs from Hollow Springs to Smithland awarded to R. J. Ward, of Correctionville, Ia.

Kans., Junction City—M. R. Amerman, Salina, Kans., awarded contract by County Commissioners for paving Grand Ave. between Junction City and Fort Riley with brick 20 ft. wide, at $411,827. Work to be completed in 70 days.

Kans., Topeka—Union Paving & Constr. Co., St. Joseph, Mo., award. contr. for surfacing W. 10th St. Rd.—city limits to 1 mi. west of Gage Pk., at abt. $44,564.

Me., Augusta—M. Hughes, 220 3rd St., Bangor, award. contr. for constr. of hwy., at $10,000.

Md., Baltimore—Baltimore Asphalt Blk. & Tile Co., Monroe & Lorman Sts., Baltimore, award. contr. to pave Parkdale Ave., at $19,050.

Mass., Boston—J. McCourt Co., Boston, award. contr. by School Comn., for grading grounds at High School of Commerce, at abt. $17,893.

Mass., Boston—Warren Bros. Co. award. contr. for repaving with bithu., Norfolk St.—Corbet St. to Blue Hill Ave.—at $77,485.

Mass., Boston—Coleman Bros. awarded the contract by the Public Works Dept. for constructing a granite block pavement in Atlantic Ave. from Kneeland St. to Summer St., with Rockport blocks, at $58,813.

Mass., Boston—James Doherty awarded the contract by the Public Works Dept. for granite block pavement on Broadway from Washington St. to bridge over Boston & Albany R. R., with New Hampshire blocks, at $16,272.

Minn., Rochester—Foley, Young & Peabody, St. Paul, award. contr. for grading and incidental wk. on 21 mi. of hwy. betw. Pine Island and Dakota Co. line, at $64,751; Leaf & Beckman, Lake City, contr. for constr. of 2 conc. bridges and culverts, at $10,972; Concrete Products Co., Elk River, contr. for section concrete, at $3,943.

Minn., St. Paul—Thornton Bros. Co. award. contr. for paving Concord St., from southerly limits St. Paul to northern end of paving in So. St. Paul, at abt. $183,000.

Miss., Canton—Maxwell & Doty, Camden, award. contr. for grading and sand-clay surfacing on 18 miles of rd., at abt. $60,000.

Mont., Cut Bank—F. M. Haas Co., Minot, N. D., award. contr. for constructing walks throughout town, at $53,515.

Mont., Missoula—Carscawn Drainage & Constr. Co., Coeur d'Alene, Ida., award. contr. for construction of natl. rd. in Yaak Valley Natl. Forest—10 miles, at $146,000.

Neb., Fullerton—National Refg. Co., Omaha, award. contr. for constructing pavements in Dist. No. 6, with sheet asph., at $45,400.

N. J., Bayonne—W. T. S. Critchfield, Jersey City, award. contr. for repairing bithu. & asph. pavements, at $25,400.

N. J., Jersey City—Clinton Contracting Co., W. Hoboken, award. contr. for paving Boulevard with bitum. conc., at $148,570.

N. J., Newark—General Contracting Co., City, award. contr. for paving Richards St., at $19,335; also Newark Paving Co., City, contr. for paving Passaic Ave., at $90,277.

N. J., Trenton—T. H. Riddle, 102 Church St., New Brunswick, award. contr. by Bd.

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Freeholders, Middlesex Co., for rebldg. 4 miles Washington Ave., Sayreville Twp., at $208,370.

N. J., Trenton—Ralph Sangiovanni, Newark, award. contr. for paving Route Hammonton-Ancora Sect., at $143,382.

N. J., Trenton—Black & Klockner, Trenton, award. contr. for grading 4.947 mi. Ancora-Atco sect. Route No. 3, at $75,381; Ralph Sangiovanni, Newark, award. contr. for constr. of Hammonton-Ancora sec. Route No. 3, at $143,282.

N. H., Nashua—Winslow & Cummings, award. contr. for rd. constr., by State Hwy. Dept., at abt. $40,000.

N. Y., Watervliet—P. W. Mulderry, 3 St. Joseph's Terrace, Albany, award. contr. for redressed granite blk. repaving on conc. fdn. on Broadway, at abt. $30,000.

N. Y., Yonkers—Malloy & Murray Contracting Co., City, bid $72,044 for improvt. of hwy. from White Plains to E. View—abt. 4½ miles; Giarcia & Ticisa, Mt. Vernon, bid $63,856, and were award. the contract.

N. D., Bowman—Sweeney & Winmill award. contr. for 17.7 miles earth road construction, involving 34,282 cu. yds. excav.; 20,520 cu. yds. turnpiking and 20,060 cu. yds. sta. overhaul, at $15,786.

N. D., Fargo—Jas. Kennedy award. contr. for paving in Third & Fourth Wards, at $23,400.

O., Canton—Highway Constr. Co., Elyria, award. contr. for resurfacing abt. 15 miles of macad. rds., Stark Co., at abt. $30,000.

O., Cleveland—Bentley Bros. Co., 403 Electric Bldg., award. contr. for grading, draining, curbing and paving; also repaving Prospect Ave.—E. 30th to E. 40th St., at $79,749.

O., E. Cleveland—Gould & Maybach, 823 150th St., award. contr. for paving 3,600 ft. on Mannheim, E. 134th St. & Carlyn Rd., brk. on 5-in. conc. base with 3,600 lin. ft. stone curb, at $32,870.

Ohio, Cincinnati—Kirchner Construction Co., 221 Ninth St., awarded contract by Board of Control for constructing brick and bitulithic pavement on Madison Road, at $303,494.

Okla., Blackwell—The Swatek Constr. Co., of Oklahoma City, was awarded the contract by the city to pave several blocks. Contract price approximately $200,000. Work will commence some time this fall.

Okla., Drumright—The B. B. Welty Co., Oklahoma City, have the contract for a $150,000 paving job in this city, and work will begin at once. Sam Sloane, Drumright, will be superintendent of construction. Streets to be paved are Pennsylvania, Ohio, Harley, Morrow & Virginia avenues, and South Ohio, Federal, Wood, E. Broadway, Drumright, Oak and Pine streets.

Pa., Berlin—Keller & Ferner, award. contr. for constr. of Brotherton-Berlin rd., at abt. $36,000 per mile.

Okla., Durant—R. A. Walker, Oklahoma City, awarded contract by Bryan County for constructing a hard-surfaced road from Durant to the county line, at about $125,000.

Okla., McAlester—J. W. Rooks, local, award. contr. to construct state hwy. betw. here and Wilburton, at abt. $20,000.

Ore., Salem—The State Highway Commission has signed a contract with the Federal Government for the improvement of the Ochoco Forest Road at estimated cost of $52,500. The highway is 9.7 miles long, of which 6.1 miles will be earth construction. Work will start immediately.

Pa., Etna—Dallas & Wardulli, 608 Larimer Ave., Pittsburgh, award. contr. for grading, paving and curbing streets in city, at $22,000.

Pa., Harrisburg—Hardy & Rankin, Canonsburg, award. contr. for constructing another sec. of Washington-Pittsburgh pike, at $209,347.

Pa., Harrisburg—Booth & Flinn, Ltd., Pittsburgh, award. contr. for 5,091 ft. on Lincoln Hwy., Ligonier Boro, at $99,385; Bunce & Carll, Olean, N. Y., contr. for 6,260 ft. in Smethport and Keating, McKean Co., at $44,645.

Pa., New Castle—Woods & Golder Constr. Co. award contr. for paving N. Liberty St., betw. Mahoning Ave. and city line, & Atlantic Ave., at $15,782 and $25,468, respectively.

Pa., Pittsburgh—D. W. Challis & Sons, Sewickley, Pa., award. contr. for improving Bethel Rd., Bethel Twp.—18,200 ft., more or less—at $120,888.

Pa., Pittsburgh—Columbus Asph. & Paving Co. award. contr. for patching Steubenville Pike Extension No. 2, west of Carnegie; also contr. for Coraoplis Heights Rd., at approx. $22,000.

R. I., Providence—B. Perini, Ashland, Mass., award. contr. for paving 723 ft. of road betw. Warren and Bristol, at $40,545.

S. C., McCormick—R. H. Wright, McCormick, award. contr. for grading and bldg. drainage structures on 11 mi. McCormick-Parksville Rd., at $3,253; 8 miles to W. R. Johnstone, Plum Branch, at $15,923.

S. D., Watertown—C. N. Atkinson Paving Co., City, award. contr. for grading, draining and surfacing with gravel, approx. 13.27 mi. of Watertown-Minneapolis Rd., at $46,283.

Tex., Colorado—Austin Bros., Dallas, award. contr. for conc. work and bridges on 16.7 miles of rd. in Mitchell Co., at $80,361.

Tex., Colorado—S. E. Brown, Loraine, Tex., awarded contract by Mitchell County Commissioners to improve Highway No. 1, including culverts, at $20,000.

Utah, Salt Lake City—The Strange-Maguire Paving Company, Salt Lake City, awarded contract by County Commissioners of David County to construct 3.7 miles of bitulithic paving on the Davis County state highway between Bountiful and Centerville, at approximately $18,000 per mile.

Wash., Bremerton—R. H. Travers, Arcade Bldg., Seattle, contr. for constr. of 11,000 sq. yds. conc. pavement on several streets; together with constr. of sewers and water mains, at $55,170.

Wash., North Yakima—Standard Asphalt Co., Spokane, awarded contract for 25 blocks of bitulithic paving at approximately $47,950.

Wash., Seattle—Bancroft & Wright, Everett, award. contr. for paving and laying 3-in. rein. conc. slab on Perm. Hwy. No. 19, and repairing present hwy. in Tolt Twp.—1.005 mi. long, 16 ft. wide—at $23,950.

Wash., Seattle—J. A. Fletcher Co., Luzerbne Apts., City, award. contr. for constr. of perm. hwy. No. 18—Kent toward Orilla, 2.31 mi.—at $58,455; D. H. Traphagen award. contr. for improvement of 13th Ave. and other streets, at $84,705.

Wash., Spokane—Mitchell Bros., City, award. contr. for curbing and paving 14th Ave.—Grand Blvd., to Monroe St.—at $34,000.

Wash., Spokane—H. C. Root, Spokane, award. contr. for grading paving and curbing 14th Ave.—Lincoln to Adams St.—at $13,160.

Wash., White Salman—Walter L. Bowen

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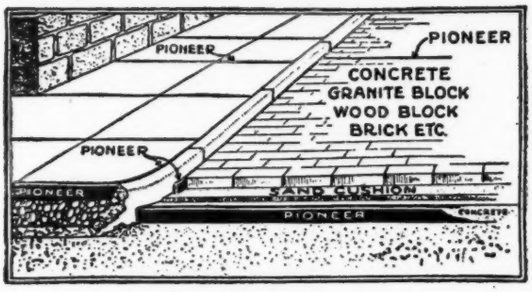

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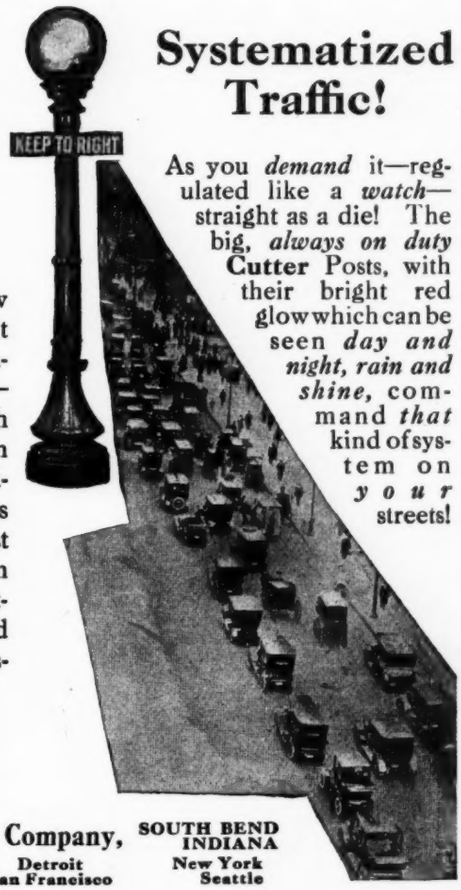

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Storms Manufacturing Co.

52 W. VanBuren St. **CHICAGO, ILL.**

is in charge of construction of the North Park Highway or State Road No. 8, and construction will begin immediately. Work includes four miles of heavy excavation between Cooks and Collins in Skamania County. Approximate cost $94,000.

W. Va., Wheeling—C. B. Kimberly Co., Wheeling, award. contr. to construct 166 sq. yds. conc. rd., and 1,000 sq. yds. conc. rds., at $16,000.

Wis., Black River Falls—J. R. McDonald, local, award. contr. for federal aid road, at $45,105.

Wis., Green Bay—Garvey & Weyenberg, Appleton, Wis., awarded contract for Federal Aid Road Construction work between DePere and Kaukauna. Includes 4½ miles of 16-ft. concrete road. $90,000.

Wis., Oconomowoc—Nelson-Weber Co., City, award. contr. for rd. work on Sparta-Mauston rd.—abt. 11 miles—at $50,000.

Wis., Sparta—Nelson-Weber Co., Oconomowoc, award. contr. for fed. aid rd., at $50,000.

Wyo., Cheyenne—Gerald V. Stack, Denver, Colo., awarded contract for 8 miles of concrete road between Sheridan and Big Horn, at $152,634.

SEWERAGE AND SEWAGE TREATMENT

Fla., Miami—J. A. Quinn, City, award. contr. for constructing san. sewers, terra cotta pipe 8 to 18-in., etc., at $27,660.

Ill., Edwardsville—Myers Constr. Co., Merchants Laclede Bldg., St. Louis, Mo., award. contr. for bldg. sewers in Distr. No. 6, at abt. $21,000.

Ill., Harvey—C. B. Russel, of Harvey, was awarded the contract for constructing the Indiana Ave. outlet sewer of Riverdale, at $3,900.

Ind., South Bend—Geo. Harrop award. contr. for installing proposed sewer sys. in Marquette Park, at $22,432.

Ia., Emmetsburg—Ward & Weighton, Sioux City, award. contr. for disposal plant for sewer system, at $6,000.

Ia., Montezuma—A. A. Quegg, award. contr. for constr. of sewer extension for Sunny Heights, at $1,793. Contract calls for abt. 2,400 ft. vitr. sewer.

Kans., Leavenworth—O'Neil Constr. Co., Leavenworth, award. contr. for bldg. sewerage sys., involving 23,000 ft. 6, 8, 10 & 12 also 15-in. sewer pipe, at $24,962.

Ky., Paris—D. A. Sant, Cincinnati, O., awarded contract by city for building 2 miles of sewers, at $19,800.

Mass., Boston—Frank Drinkwater, 35 Hemlock St., W. Roxbury, award. contract for constr. of sewerage works, Washington St., betw. N. Y., New Haven and Hartford R. R., and Archdale Rd., W. Roxbury, at $7,242.

Mass., Haverhill—E. C. Johnson, Newburyport, award. contr. for constr. of Kenoza sewer, at $19,800.

Mass., Walpole—Moore & Co., 30 Pemberton Bldg., Boston, award. contract for improving water system, at about $150,000.

Mich., Dearborn—Colman & Harding, Detroit, awarded contract for constructing sewers at $144,801; and Angelo Stafani, Detroit, awarded contract for sewerage works construction at $31,051.

Minn., Argyle—Schruth & Jackson, Fargo, N. D., award. contr. for constr. of sewers and water systems, at $53,000.

Minn., St. Paul—Thornton Bros., Scandinavian-Am. Bank Bldg., award. contract for constr. of W. St. Anthony Park sewer system, at $6,970.

Minn., St. Paul—E. T. Webster, 437 Beacon St., City, award. contr. for constructing storm water relief sewer on Como Ave., at $5,387.

Minn., Tromaid—Pastoret Constr. Co., 611 Lyceum Bldg., Duluth, award. contr. for sewer and water works systems, at $61,000.

Neb., Randolph—W. B. Carter, Sioux City, award. contr. for sewerage and disposal plant, at abt. $23,211.

N. Y., New York—Peter B. Stanton, 2327 Walton Ave., New York, awarded contract by President Bruckner of Bronx Boro to complete the Blondell Ave. sewer, at $744,608.

Thiells, N. Y.—C. Nally, 710 Columbus Ave., N. Y. City, award. contr. for bldg. underground sewer and water connections at abt. $35,700, in Letchworth Village.

N. M., Clovis—C. Fisher & Co., Phoenix, Ariz., award. contr. for bldg. sewer extensions, at about $14,643.

N. D., Minot—G. W. Kemper, Minot, award. contr. for storm sewers, at $2,300.

O., Lancaster—J. W. Strachan awarded contract by Public Service Director for constructing the high school sewer from school building to Maple St. sewer at $1,340.

O., Lockland—J. B. McLane & Co., Newport, Ky., award. contr. for laying 2,245 lin. ft. 12, 18, 30 & 36 in. sewer pipes in N. Cooper, Westview and Pershing Aves.; also Bacon St., at abt. $13,137.

O., Lorain—Tony Trifelletti, 319 13th St., award. contr. for approx. 250 lin. ft. 15-in., 2,800 ft. 12-in. vitr. tile sewer in 7th St., at $2,800.

O., Toledo—Peters Bros. Contracting Co. award. contr. to build a mile and a half of sewer on Pomeroy's Stickney Ave. Addn.

Okla., Tulsa—Comstock & Hansen, Cedar Rapids, Ia., awarded contract by city to construct sewer system, at $45,153.

S. D., Eureka—Philip Schamber, City, award. contr. for constructing addns. to present sewer sys., at $1,604.

Tex., Electra—Winslett & Eldridge Co., Dallas, award. contr. to construct sewer system and disposal plant, at $52,388.

Tex., Houston—Thos. Tellepson, City, award. contr. for constructing dewatering plant at No. Side disposal station at abt. $23,000.

Utah, Salt Lake City—M. Palm award. contr. for constr. of sewer on Sunnyside Ave., at $2,413.

Va., Richmond—H. L. Driscoll, 151 Colonial Ave., City, award. contr. for bldg. sewers in Semmes Ave.—33rd & 34th Sts.; Hill St.—14th St. to Cowardin Ave.; Meadow Brdg. Rd.—Valley Rd. to Cannon St.; 21st St.—U to Fairfield St., at $264, $10,395, $3,965 and $2,209 respectively.

Wash., Seattle—Geo. Dijulio Co. awarded contract for constructing sewers in north and west 40th St., at $4,442.

Wash., Spokane — James C. Broad awarded contract for constructing sewer in 19th St. from Hatch to Grand, at $7,965, and for curbing and cross-walking Shannon from Howard to Monroe, at $2,427.

Wis., Madison—Brogan & Burns, of Green Bay, Wis., awarded the contract to install the sewage force main in the Wingra sewer district, consisting of 2,000 ft. of 12 in. cast iron pipe, at $3,300.

Wis., Manitowoc — Gray-Robinson Co. award contr. for constructing sewer, at $6,516.

Wis., Washburn — Gray-Robinson and Company awarded contract for constructing 9 blocks of sewer on Omaha St. & Third Ave., at $10,000.

WATER SUPPLY AND PURIFICATION

Ct., Hartford—O'Neil Bros., City; also A. C. Sternberg, Inc., W. Hartford, award. contr. for constructing approx. 4,800 ft. of 48-in. rein. conc. conduit, at $131,330.

Ct., Waterbury—Natl. Meter Co., 299 Broadway, New York City, award. contract for installing water meters, at abt. $114,250.

Ill., Chicago Heights—Rust Engrg. Co., New York Life Bldg., Chicago, award. contr. for constructing one conc. standpipe, 235,000 gal. capy., at $7,850.

Ill., Witt—Downey & Son, local, award. contr. for bldg. pumping station at $5,719, also water tower, at $6,300.

Ia., Emmetsburg—Des Moines Bridge & Iron Co., award. contr. for erection of standpipe for new water works sys., at $6,125; Peter N. Kruse, Spencer, award. contr. for mains, at $4,080.

Kans., Topeka—A. R. Stimpson, City, award. contr. for constructing new pump pit near water works, at $9,400.

Md., Baltimore—Evans Constr. Co., engaged by city to secure labor and supervise constr. of water mains for 3rd sect. of Key Hwy., est. cost $8,000.

Mass., Walpole—Moore & Co., 30 Pemberton Bldg., Boston, award. contr. for improving water sys., at abt. $150,000.

Mich., Ironwood—Peter Megan, city, award. contr. for excavating and constructing conc. reservoir of one million gal. capy., at $200,245.

Mo., Fayette—Lane & Bowler Company of Memphis, Tenn., awarded contr. by the city at $9,990 to drill wells with a guaranteed daily flow of 150,000 gals.

Mo., Rich Hill—Merkle Machy. Co., 508 Interurban State Bldg., Kansas City, award contr. for improving water works and electric light plant, at abt. $11,600.

Mich., Wayne—Brooks Sons Co., Jackson award. contr. for laying 12,700 ft. 4-8-in. water mains, etc.

Minn., Trommaid—Pastoret Constr. Co., 511 Lyceum Bldg., Duluth, award. contr. for water works and sewer sys., at $61,000.

Mont., Livingston—Richard Hooper, Kansas City, Mo., award. contr. for constr. of city reservoir, at $28,000.

N. Y., Brooklyn—Knight & DeMicco, 2353 Washington Ave., New York City, award. contr. for hauling and laying water mains in Bay E. 28th and 61st St., 8th and Newport Aves., at $39,063.

N. C., Raleigh—Tucker & Laxton, Charlotte, award. contr. for water works improvements, at $50,000.

N. D., Williston—Geo. W. Kemper, Minot, award. contr. for water works improvements, at $109,000.

O., Akron—Shulle Bros. & Co., 896 Kling St., award. contr. for water wks. constr., at abt. $8,291.

O., Lorain—The Pittsburgh Filter Co., Farmers Bank Bldg., Pittsburgh, Pa., awarded the contract for filter equipment at abt. $100,000.

O., Lowellville—Turner Contg. Co., W. Federal St., and Tod Lane, Youngstown, award. contr. for finishing extension of water wks. sys., digging trenches, laying public mains, etc., $25,278.

O., Toledo—S. L. Cathrel, 341 Ohio Bldg., award. contr. by Lucas Co., for laying 15,570 ft. 6-in. water pipe, hydrants, valves, etc., at $28,405.

Pa., Ft. Mifflin—Henry F. Lodge, Inc., 1633 Ranstead St., Phila., award. contr. for water and sewer connections, at $30,000.

Pa., Phoenixville—A. H. Rush, award.

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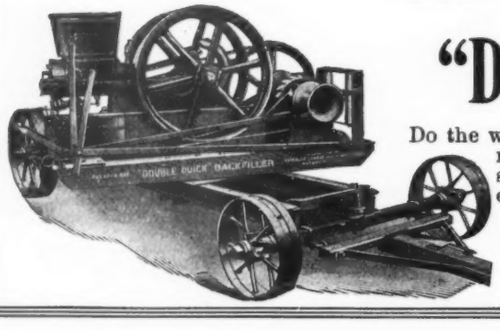

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contr. for constr. of conc. retaining wall at pumping station, at $2,869.

S. D., Newell—W. C. Buck, Minneapolis, awarded contract by City Council to install modern system of water works, including a 2,000,000-gal. reservoir, a 50,000-gal. elevated tank, a pumping plant, a water purification plant and necessary buildings, at about $45,000.

Utah, Spanish Fork—Chris. Larson, city, award. contr. for constr. of 100x100 cem. reservoir, including 7 miles redwood pipe, at $37,375.

Wn., Seattle—F. N. Badolato, award. contr. for laying water mains in Baker Ave., at $10,367.

Wyo., Newcastle — Security Bridge Co., Billings, Mont., award. contr. for constructing waterworks sys., at $75,000.

BRIDGES AND BUILDINGS

Ala., Opelika—Stanley & Singer Constr. Co., Lafayette, Ala., award. contract to construct 60-ft. conc. bridge across Opelika Crk. on State Trunk Rd. No. 13, at $5,276.

Ark., Lonoke—The Southern Road & Bridge Builders' Co., of Little Rock, awarded contracts for construction of 3 bridges in Lonoke county at approximately $19,700.

Cal., Redding—Wm. Stephens, Redding, award. contr. for bridge across slough at Balls Ferry, at $14,827; D. E. Albers, Santa Rosa, award. contract for constr. of brdg. 100 ft. long across Churn Crk. on Redding Millville rd.; also similar brdg. across same creek in Churn Crk. bottom, at $5,000.

Cal., Red Bluff—Bordwell & Zimmerman, Napa, award. contr. for constr. of 2 rein. conc. arch bridges at $38,000.

Cal., San Diego—L. E. C. Smith, National City, awarded contract for construction of a reinforced concrete girder bridge of 40-ft. span across Buckman Creek on state highway at $6,180.

Cal., San Diego—Wright & Doran, 931 S. Broadway, City, award. contr. for constructing rein. conc. girder bridge, at $68,-000.

Cal., San Jose—A. Scarrino, award. contr. for constructing 5 conc. brdgs. in Santa Clara Co., at approx. $13,343.

Cal., Santa Barbara—Chas. J. Erickson, award. contr. for constr. of rein. conc. bridge over Picay Crk. in second rd. distr. at $2,275.

Cal., Somis—F. E. Hill & Co. awarded contract for building the Somis culvert, at $3,335. Work to be finished by Sept. 15.

Cal., Stockton—Ward Bros., San Diego, awarded contr. for erection of six bridges in Shasta Co., at $25,373.

Cal., Yreka—A. L. Lamp, **Montague**, award. contr. for rein. conc. brdg. over Shasta River, at $9,930; also conc. bridge over McAdams and Moffit Crks., near Fort Jones on new county hwy., at $3,100.

Colo., Denver—Colorado Bridge Constr. Co., award. contr. for bldg. brdg. over Clear Crk., consisting of two 66-ft. spans, at abt. $11,990.

Conn., Bridgeport—The Eastern Engineering Company, Derby, Conn., awarded contract at $900,000 to build bridge for the city of Bridgeport.

Ga., Dalton—Luten Bridge Co., York, Pa. award. contr. for constr. of 2 bridges by Comrs. Whitfield Co., at $6,985.

Ida., Whitebird—Security Bridge Co., Lewiston Natl. Bk. Bldg., Lewiston, award. contr. for constructing brdg. over Salmon River, at abt. $23,000.

Ill., Astoria—H. C. Holmes, Macomb, award. contr. for rein. conc. brdg., at Sheldons Grove, at $4,410.

Ill., Carthage—M. A. Munson, city, award. contr. for constr. of Cheney brdg., Pilot Grove Twp., Hancock Co., at $3,700.

Ill., Moline—Julius Keg, Blue Island, Ill., award. contr. for constr. of large and small bridge at Fox Lake, at $24,665.

Ill., Pekin—Howard Porter, Mackinaw, award. contr. for constructing new 30-ft. span, replanking, etc., on bridge in Sand Prairie Twp., Tazewell Co., at $5,482.

Ill., Springfield—W. C. Johnson, Bellville, awarded contract for constr. bridge in Sangamon county at $17,890.

Ill., Springfield—Hustedde & Burhorn, award. contr. for Gerdes and Huelsman bridges, Breese Twp., Clinton county, at $2,365; M. A. Munson, Carthage, Ill., contr. for Cheney brdg., Pilot Grove Twp., Hancock Co., at $3,700.

Ill., Springfield—Harry C. Holmes, Macomb, Ill., award. contr. for constr. of Sheldon's Grove brdg., Hickory Twp., Schuyler Co., at $4,410; Button Bros., award. contr. for constr. of Armsby brdg., at $1,455; E. E. Buck, contr. for Hoffman No. 1 brdg., Rushville Twp., Schuyler Co., at $1,850.

Ind., Brookville—Marshall & Meredith, Richmond, Ind., award. contr. for constr. of conc. arch bridge, 80 ft. and fill, over Big Cedar Crk., Highland Twp., at $7,780.

Kans., Fort Scott—Republic Constr. Co., Republic, award. contr. to build 3 bridges; also Concrete & Steel Constr. Co., Joplin, award. contr. for bridge construction, abt. $20,000.

Ky., Shelbyville—The Champion Bridge Co. awarded contract by Shelby Fiscal Court for constructing 3 bridges, 1 over Clear Creek, 1 over 6-mi. creek and the other Can Run at $2,800.

Ind., Columbus—D. H. Fatout, Indianapolis, award. contr. for conc. arch over Lick Crk., near Huber's Sta., at $3,395.

La., Tullulah—J. H. Scruggs Constr. Co., Amer. Tr. Bldg., Birmingham, Ala., award. contr. for bldg. one 30-ft. bridge over Bayou Brushy, Fortune Fork; one 30-ft. brdg. over Bayou Mack at Bruces plantation and one 60-ft. bridge over Bayou Bull Calf at Bozeman plantation, rein. conc., at abt. $10,000.

Minn., Anoka—Illinois Steel Brdg. Co., St. Paul, award. contr. for constructing bridges Nos. 2896, 97, 98, 99, 2900, 01, at $11,996.

Minn., Fond du Lac—Geo. H. Lounsberry, 322½ E. Superior, Duluth, award. contr. for bridge over St. Louis river, at $108,682.

Minn., Northfield—Peter Nelson award. contr. for constr. of two brdgs., at $4,214.

Minn., Roseau—Minneapolis Bridge Co., 1035 Metropolitan Bank Bldg., Minneapolis, award. contr. for part of Job No. 1805, state brdg. 2838, across Roseau River, at $7,345.

Minn., Stephen—Valley Construction Co., Warren, Minn., awarded contract for steel and concrete bridge across Tamarac River, at $2,975.

Minn., Willmar—Guaranty Constr. Co., 834 Palace Bldg., Minneapolis, award. contr. for State Brdg. 2938. State Rd. No. 3, 30 ft. beam span, rein. conc. abuts., at $3,460.

N. D., Forman—Iowa Bridge Co., 717 McKnight Bldg., Minneapolis, Minn., awarded contract for concrete bridges in Sargent County, at $13,500.

N. J., Jersey City—Bethlehem Steel Brdg. Corp., So. Bethlehem, award. contr. for repairing Passaic River brdg., at abt. $10,000.

Pa., Allentown—Butz & Clader award contr. for constructing rein. conc. bridge over Outalaunee Crk., near Lynnton, at $23,000.

O., Circleville—Richelderfer Constr. Co., local, Stout & Stout, Stoutsville, and H. C. Inder, Whisler, award. contracts for bridge constr., at $5,605, $2,496 and $1,386, respectively.

O., Newark—Illinois Brdg. Co., 1623 Monadnock Blk., Chicago, award. contract for bridge over Racoon Crk., St. Albans Twp., at $7,647.

O., Youngstown—N. R. Porterfield will build a reinforced concrete bridge to cost about $14,000, on the Cox Highway about a mile east of Alliance.

Pa., Doylestown—M. F. McPeek award. contr. for bldg. rein.-conc. arch hwy. bridge over N. Branch of Neshaminy Crk. near Chalfont Boro, New Britain Twp., at abt. $12,500.

Pa., Easton—Butz & Clader, of Allentown, awarded contract by Lehigh County Commissioners for building bridge over the Ontelaunee Creek at Lynnport, at $23,000.

Pa., Keystone—L. H. Focht & Son, 529 Court St., Reading, award. contr. for repairing bridge over Schuylkill River at this point, at $20,000.

Pa., Kittanning—Ferris Engrg. Co., Empire Bldg., Pittsburgh, award. contract for repairing bridge over Kiskiminetas River, at $13,200.

Pa., Lynnport—The Lehigh County Commissioners have awarded to Butz & Clader, of Allentown, Pa., the contract for construction of concrete bridge over the Ountelaunee Creek at Lynnport, for $23,000.

Wash., Colfax—H. C. Malott, Seattle, awarded contract by county commissioners for construction of 2 concrete bridges near Colton and Farmington, at $3,790 and $12,-985, respectively.

Wash., Seattle—Charles G. Huber, Central Bldg., Seattle, awarded contract for construction of 180-ft. steel bridge over Nisqually River at Elbe, at $17,985.

W. Va., Middlebourne—Geo. F. Watson, City, award. contr. for completion of bridges ready for fills over Sugar Crk., Elk Fork Crk., and Middle Isl. Crk., at $16,263.

W. Va., Morgantown—Geo. F. Watson, Middlebourne, award. contr. for constructing 3 conc. arch bridges, at $10,823, $5,625 and $2,800.

Baraboo, Wis.—Whitewater Brdg. Co., Whitewater, award. contr. for constr. of bridge, at $2,326.

Wis., Green Bay—John Roberts, DePere, award. contr. for abuts. to Devil River brdg. on Blake Rd., at $2,500.

Wis., Green Bay—Garvey & Weyenberg Construction Co., Appleton, awarded contract for building 70 ft. span bridge of reinforced concrete at $13,365.

Wis., Hayton—J. Young, Oconto, award. contr. by Calumet Co., for constructing one 45-ft. rein. conc. arch bridge, 24 ft. wide, at abt. $10,000.

Wis., Prairie du Chien—John Helgerson, Soldiers Row, Wis., awarded contract for Peterson Bridge, Town of Utica, at $5,075; W. H. Shons, Freeport, Ill., awarded contract for Rush Creek truss bridge, at $4,500.

Wis., Superior—Philip Debock, S. Range, award. contr. for Lee brdg., at $2,790, rein. conc.

Wis., Theresa—Worden-Allen Co., Milwaukee, award. contr. for steel and concrete bridge, at $10,598.

Wis., Wrightstown—Garvey & Weyenberg Constr. Co., Appleton, award. contr. for 70-ft. span, at $13,365.

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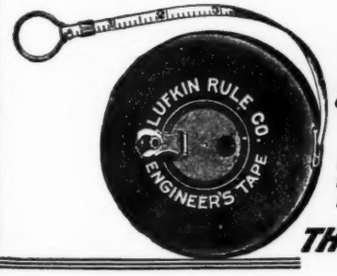

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PROSPECTIVE WORK

ROADS AND STREETS

Ala., Montgomery—War Department considering expenditure of $140,000 for road construction at Camp Sheridan. M. G. McDonald, Camp Constr. Q. M.

Ala., Opelika—Lee Co. Commrs. contemplate constructing hwy.—Opelika to Gold Hill—abt. 12 miles.

Ariz., Phoenix—About 5 miles of concrete road will be built at once between the Grand Canal and Tempe, at a cost of about $20,000 per mile. Cost will be shared equally by state and Maricopa County.

Ark., Arkadelphia—Surveys completed for the two proposed Clark County highways, and specifications are being prepared to receive bids. Estimated cost $180,000.

Ark., Corning—State Highway Dept. has prepared preliminary plans for road in Scott County from Waldron south to the Forest Reserve. It will be graded and 23 miles in length. Approximate cost, $84,700.

Ark., Jonesboro—County Commissioners of Craighead County are considering the question of submitting to voters a proposition to issue road bonds to the amount of $400,000.

Ark., Little Rock—The proposed Baxter County Highway will be a graded earth road from the Searcy County line via the town of Big Flat to the Stone County line, a distance of 7½ miles. Estimated cost, $11,791.

Ark., Pine Bluff—The Jefferson County Commissioners will spend $40,000 for resurfacing the Tamo Road.

Ark., Sheridan—Gravel Rd. will be constructed by Grant Co. Commrs.—Sheridan So. through Millerville to Dallas Co. line. $80,000 bonds issued. Parkes Engrg. Co., Pine Bluff, Ark., Engr. Ed. Hamilton, Secy. Comrs.

Cal., Los Angeles—Resolution adopted by City Council to build paved rdway. from plant of So. Western Shipbldg. Co. to Seaside Ave. on Terminal Island. Est. cost, abt. $65,000. City will pay one-half the cost; City will also construct paved rd. from plant to Los Angeles Shipbldg. Co. to the Harbor Blvd., abt. $20,000.

Cal., Madera—Bids soon to be asked for paving 6th St. Est. cost $39,054. City Trustees have also decided to pave A St.—5th to Central Ave. Est. cost $13,234. Sloan & Robson, Nevada Bk. Bldg., San Francisco, Engrs.

Cal., Oakland—Project submitted to City Council by Merchants' Exch., outlines constr. of blvd. through valley to link E. Oakland and Berkeley by short route. Proposed blvd. will be abt. 12 miles in length.

Cal., Pasadena—H. R. Postle, Fed. Engr. office public rds. Dept. of Agric., is in Pasadena to take charge of the survey of extension work on Arroyo Seco road. City will pay portion of cost of improvement.

Cal., Santa Ana—Construction of rd. 9,835 ft. long being considered. Rd. will run around Sulphur Slide, Santa Ana Canyon. Est. $52,000. J. L. McBride Co., Surv., Orange Co.

Cal., Yreka—Federal Govt. has decided to improve rd. down Klamath to Sexad—abt. 50 mi.—to permit hauling chrome in motor trucks. $10,000 will be contributed by Co. to this work.

D. C., Washington—Government contemplates constr. of 60 miles of Gallup-Mesa Verde National Hwy., within Navajo Indian Reservation. Approx. cost $54,000. Cato Sells, Comr. Ind. Affairs.

Fla., Jacksonville—New bids will be asked for paving Talleyrand Ave. Est. $39,360.

Fla., Quincy—State Hwy. Engrg. Dept. estimated cost of bldg. proposed Feather River Hwy.—Yankee Hill to point on Indian Valley—Quincy Rd.—in excess of $1,000,000.

Fla., St. Petersburg—City Commrs. have decided to pave with brk. street leading to mainland end of new brdg. to Long Key across Boca Ceiga Bay; also to pave Park St.—Fifth Ave. So. to Village Ave., and Villa Grand Ave. from Park St. to the bay, at the foot of Villa Grande Ave.

Ida., Glenns Ferry—$200,000 bonds voted by Hwy. Distr. for improvement of roads in this vicinity. F. E. Wilson, Pres.

Ia., Ames—City Council will repair creosoting wood block paving on Main St. by relaying portion of blocks and by application of coating pitch. Work involves 2,000 sq. yds. of relaying and 30,000 sq. yds. pitching and sanding.

Ia., Marion—City will gravel Lincoln Highway between Marion and Big Creek bridge, a distance of 6 miles.

Ind., Shelbyville—Bartholomew and Shelby Cos. considering constr. of improved hwy. from Hope to Indianapolis; two routes under consideration, one Michigan Rd. No. into Indianapolis, and the other route leading northwest through Boggstown and Beech Grove.

Ia., Sioux City—Bids soon to be asked on Woodbury Co. rd. proj. which includes one mile conc. paving, and abt. 50 miles of grading. Dept. Public Rds., Washington, has approved project. Est. cost abt. $150,000, of which amt. Government has agreed to pay $68,500. Grading work will run from here to Sioux City and Smithland.

La., Slidell—The city will improve streets at an estimated cost of $30,000. L. Badon is mayor and Xavier A. Kramer, of Magnolia, Miss., is consulting engr.

La., Thibodaux—Lafourche Parish Police Jury, Road District No. 2, with L. C. Rogers in charge, will construct by day labor 20 miles of hard surfaced roads; $80,000 available.

Mass., Adams—The Board of Trade is interested in getting a state appropriation for the building of a permanent road over the route from Adams to E. Cheshire, Savoy and West Commington.

Mass., Roxbury—Centre St.—South to Spring St.—will be reconstructed and widened. Est. cost $340,000.

Md., Baltimore—Officials of the State Road Commission have gone to Washington to urge Capital Issues Committee to approve $1,500,000 state road bond issue authorized by last legislation.

Mich., Cassopolis—Cass County contemplates bldg. roads—abt. $20,000. W. W. Reynolds, Engr.

Mich., Grosse Point—$99,000 bonds voted for curbing and paving 7,000 ft. East Jefferson Rd.—creo. wood blk. or brk. on conc. base. T. Campau, Engr.

Mich., Marshall—City contemplates bldg. dirt rd. 3,000 ft. long; also wooden bridge across Kalamazoo river on Battle Crk. & Bedford Twp. line. Est. cost abt. $15,000.

Mich., Monroe—The Capital issues commission at Washington, D. C., has signified

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SPRINGFIELD, ILLINOIS

Helping to Win the War

In the columns of Kaiser Wilhelm's subsidized press, considerable space has been devoted of late to gloating over the alledged abandonment of foreign advertising and curtailment of home advertising by American manufacturers. The Du Pont Company, however, is one to which the stricture of the Kaiser's press does not apply. Instead of reducing its advertising expenditures, the Du Pont Company *doubled* its appropriation for the present year over that of the previous year, and is planning to increase the sum still further for 1919.

The courageous action of the Du Pont Company (Wilmington, Del.) in doubling its advertising expense at a time when business conditions bordered on the chaotic, served, no doubt, as an inspiration to other great companies which have since been following in the Du Pont footsteps and are keeping their names and products constantly before the public eye.

its approval of the $200,000 road bond issue recently voted by Montor County, and unfinished roads will be speedily completed.

Minnesota, Minneapolis—Capital Issues Comm., approved issuance of $73,989 worth of bonds for paving of Centar Ave. Under general rd. bldg. plan Cedar Ave. will be extended into Dakota Co., to connect with Jefferson Hwy.

Minn., St. Paul—Ramsey County contemplates grading & surfacing 12 roads, 14 miles long, 16 ft. wide, clay, gravel and asph. macad. Abt. $100,000. G. J. Reis, Co. Aud.

Mo., Marshall—A special election will be called to vote $85,000 in bonds to improve the National Old Trails Route across Saline County. This is a state and federal aid project.

Mont., Great Falls—Final survey of Sun River rd.—this city to Sun River — (19 miles), will be started at once. O. A. Ruffner, Govt. Engr. in charge. L. V. Lockwood will supervise constr.

Mont., Helena—Contracts will be awarded on 3 Fed. aid hwys., as soon as approval is received from Secy. of Agriculture. Projects involve improvement of 25 miles of rd. Est. $89,581.

Mont., Lewiston—New road will be constructed across the Divide from Beckett to N-Bar ranch. Bids soon to be asked by Co. Commrs.

N. H., Manchester — Resolution introduced providing for issuance of $135,000 bonds for bldg. new streets, and making other municipal improvements.

N. M., Gallup—City considering paving 5,280 ft. Front, Coal, 1st, 2nd and 3rd Streets (16 blocks); 1-course 6-in. conc., 42 ft. wide. L. S. Miller, Santa Fe, Engr.

N. M., Las Cruces—Dona Ana Co. considering constr. of 11-mile road from Mesquite to Las Vegas.

N. J., Paterson—Bd. of Freeholders, Passaic Co., considering paving Ringwood Ave., Pompton Lakes. Est. cost $30,000. Garwood Ferguson, Co. Engr.

Nev., Reno—Dept. of Hwys. reports approval of 3 important hwy. projects within the state by Fed. Govt. Constr. will begin within near future; 1st road to run from Reno to Huffaker; second—Tonopah to 17 mi. northeast; third—Lovelock to 17 mi. easterly. Govt. will contribute equal amt. of money with state and county.

N. Y., Coddington Point—Bureau Yds. & Docks, Navy Dept., Washington, considering bldg. roads and walks. Est. cost, $190,000.

N. Y., Jamaica—City of New York planning to build Jamaica Bay Blvd. (Cross Bay Blvd.) 5 mi. long, 100 ft. wide, 8,550 ft. trestle 50 ft. wide, including 4 20-ft. spans. Project includes 2 lift brdgs. 200 ft. long. Total cost, including brdgs., $800,000; project also includes sewer in Genesee St.—Conduit to Wartman Ave., Jamaica, at cost of $221,000.

N. Y., New York—$100,000 will be spent on street improvements in Long Island City, Elmhurst, Flushing & Jamaica districts. Bids soon to be received.

N. C., Charlotte—City will resurface 30,000 sq. yds. of old bitulithic pavement and will place 6,000 sq. yds. of new pavement to carry heavy traffic. W. E. Vest, city engr., A. H. Wearn, com. of public works.

O., Akron—Ordinance has been passed to issue bonds to resurface So. Main St., from Thornton to Corsier St., at an estimated cost of $50,000. J. B. Merriman is president of council.

O., Springfield—City Council has passed ordinances providing for issuance of paving bonds aggregating $52,000.

O., Springfield—National Pike—Titus Rd., just east of here, to Madison Co. line—abt. 9.39 miles—will be rebuilt and put in good condition. Just as soon as estimates are approved by Washington bids will be asked. Three materials are proposed for reblg. the pike: conc., $262,100; bithu. pav., $229,600, and national pav., $220,700. State will pay one-half the cost.

Ore., Portland—U. S. Office Pub. Rds. has approved Fed. aid rd. projects calling for Fed. expenditures of $436,983. Rds. are as follows: John Day Hwy., Wheeler Co., 9.47 mi. grading, est. $36,733; Elgin to top Wallowa Hill, Union Co., 9.3 mi. grading, $36,094; Jno. Day hwy., Grant and Wheeler Cos., 48.45 mi. grading, $400,433; Pacific hwy., Marion Co., 16.7 mi. surfacing with bitum. macad., $352,446; Old Oregon trail, Union Co., 6 mi. grading, est. $13,917; Baker to Cornucopia Sag, Baker Co., 4.9 mi. graveling, $41,926; Yamhill to Nestucca, Yamhill Co., 6.8 mi. surfacing with gravel-macad., $81,315.

Ore., Salem—State Highway Engineer, Herbert Nunn, has reported to the governor that Oregon will have available during the years 1919 and 1920 for the development of good roads, the sum of $15,000,000.

O., Steubenville—Under the terms of an agreement betw. Co. Commrs., State Hwy. Dept. and Cleveland & Pittsburgh R. R., the railroad company will expend betw. $40,000 and $45,000 to reblg. Yellow Crk. Co. road, in connection with constr. of its "Y" at Yellow Creek.

Pa., Allentown—Plans under way to improve the 12 miles of road betw. here and Kutztown. New road will cost abt. $17,000 a mile, part of which expense will be paid by the state and part by fed. government. Work to begin very soon.

S. C., Greenville—Greenville Co. Commrs. contemplate resurfacing Buncombe Rd.—San Souci for dist. of 3 miles—also August Rd., with tarvia mortar mixt. F. P. Patton, Co. Engr.

S. C., Greenville—Plans under way to improve Jones Gap rd.—Greenville to Brevard. $37,000 available for the work.

Tex., Austin—Gov. Hobby, of Texas, is advocating the construction of a military highway from Florida to California, a distance of between 5,000 and 6,000 miles. The project would call for an expenditure of about $50,000,000.

Tex., Austin—The attorney general has approved a $90,000 bond issue for Henderson County Road District No. 1.

Tex., Galveston—The U. S. Navy Dept., under local charge of L. B. Hyde, Engr., U. S. Navy, will construct roads for the new $2,000,000 aeroplane training camp.

Tex., Kerrville—County election resulted in favor of issuing road bonds to the amount of $60,000.

Tex., McKinney — Collin County has quoted $50,000 bonds for construction in Allen Road District No. 5.

Va., Bedford—The Bedford County Board of Supervisors have appropriated $15,000 for the construction of the national highway from Lynchburg to Nashville bridge.

Wash., Mt. Vernon—The Capital Issues Committee has sanctioned the issuance of road bonds to the amount of $177,000.

Wash., Seattle—City contemplates paving 4th Ave., So. Est. cost $215,000. Specifs. include 300,000 cu. yds. earthwork, 14,700 sq. yds. monolithic paving, 6,560 ft. pipe, 17 hydrants, etc.

Wash., Spokane—Ord. passed by City Council to pave 14th Ave.—Monroe St. to Grand Blvd. Est. cost $30,000.

W. Va., Elkins—The Roaring Creek District of Randolph County has voted $92,000 to improve roads. F. A. Parson is county road engineer.

W. Va., Kingwood—Preston County contemplates grading and draining 3.9 mi. Kingwood and Terra Alba pike, Portland Distr.—Chaddell to Rag Tavern. Will improve surface later. Abt. $20,004. H. Wilhelm, Kingwood, Engr.

W. Va., Lewisburg—Greenbrier Co. considering paving 2.54 miles Roncevette and Lewisburg Rds., 14 ft. wide, asph. conc. top, 6-in. macad. base. Abt. $32,621. R. Holt, Lewisburg, Engr.

W. Va., Martinsburg—City will pave sections of West King and East Martin Sts. with brick; $210,000 in bonds available.

SEWERAGE AND SEWAGE TREATMENT

Ariz., Globe—Bids will be asked abt. September for 17 miles of sewer construction; also disposal plant to cost approx. $240,000. Benham Engrg. Co., Okla. City, Okla., preparing plans.

Cal., Newport Beach—The city is to have a new sewer system costing $100,000. Paul E. Kressly is consulting engr. Bids will be received until August 19.

Ca., San Diego—Navy Dept. has authorized Commander Leonard M. Cox, Timken Bldg. (Pub. Wks. Officer of 12th Naval Distr.) to construct new sewer sys. at naval coaling station, at La Plava.

Cal., San Pedro—Asst. Harbor Engr. Ludlow has been requested by Harbor Comn. to immediately prepare plans for new outfall sewer sys. for Terminal Island.

Ct., Stratford—$150,000 appropriated for constr. of large trunk sewerage system with term. at Housatonic Ave., near Housatonic River. P. Goodell, Engr., Bridgeport, preparing plans.

D. C., Washington—Government will enlarge and improve sewage plants at all camps and cantonments. Work to be undertaken immediately by Construction Div. of the army. Est. cost abt. $40,000 for each camp.

Fla., Monticello—This city contemplates the construction of a complete system of sanitary sewers.

Ga., Macon—$55,000 bonds voted by city for san. and storm sewer extensions. D. S. Jones, Clk.

Ga., Thomson—$21,000 bonds voted by city for sewer construction.

Ill., Carlinville—The city will install a sewerage system at an estimated cost of $28,722. The Caldwell Engr. Co., of Jacksonville, are consulting engrs.

Ind., Kendallville—City Engineer has been instructed to draw up plans & specifications for adequate storm sewer for territory lying east of Main St., and on both sides of N. Y. Central tracks.

Ia., Mt. Pleasant—Plans under way for constr. of sewers in Distr. No. 2. Work includes 260 ft. 8-in., 1,500 ft. 10-in., 4,000 ft. 12-in. and 4,000 ft. 15-in. sanitary sewer. W. D. Worthington, Clk. M. G. Hall, Centerville, Engr.

La., Oakdale—X. A. Kramer, Magnolia, Miss., engaged by city to prepare plans and estimates for san. sewer system. Est. cost $30,000.

La., Winnsboro—The city will construct sidewalks, sewers and water works at estimated cost of $80,000. Xavier A. Kramer, Magnolia, Miss., consulting engr.

Mass., Beverly—Edw. Thompson, Chrmn. Public Service, will receive bids soon for sewers in Bridge, Essex and Cedar Sts.; also for syphon sewer across Bass River.

Mass., Boston—City will build san. sewers in various sections. Est. cost abt. $10,326; also 30 catchbasins with manholes and connections in B'way and other thoroughfares. Est. at $6,505. Work will be done by day labor.

Mass., Boston—Bd. Pub. Wks. contemplates reblg. 13 catchbasins; 85 lin. ft. 5½ ft. conc. surf. drain in Archdale Rd.; 75 lin. ft. 15-in. pipe surf. drain on Waldon Rd., 35 lin. ft. 12-in. surf. drain, Mahler St.; 40 lin. ft. 12-in. surf. drain, Lochdale Rd., and 20 lin. ft. 10-in. pipe san. sewer Tollgate Rd. Abt. $10,325. E. P. Murphy, City Engr.

Mich., Battle Creek—Dept. of Public Wks. has submitted plans with specifs., diagrams, estimates, etc., on cost for new sewer in Opton Ave. $18,000.

Mich., Detroit—All bids submitted to the Essex Border Utilities Commission for eastern section of intercepting sewer system of the Border cities were rejected, and new bids will be asked. Probably on a cost-plus basis.

Mich., Ferndale—Ferndale Comn. has appointed Comm. to investigate possibility of extending Detroit 10-in. water main, now under constr. on Woodward Ave., betw. Seven & Eight mile roads, through this village. May issue bonds in sum of $62,000 for sewer and water improvements.

Mich., Highland Park—$80,000 voted by city for purpose of constructing sewerage system. Plans awaiting approval of Govt. L. C. Whitsit, City Hall, Engr.

Mich., Muskegon — City contemplates installation in Muskegon Heights of comprehensive sewage collection system with 4 or 5 miles of trunk line sewers with necessary lateral.

Mich., Muskegon—City c ontemplates constr. of sewer on Spring St.—Apple St. to Wood Ave.; also on Wood Ave.—Spring St. to Forest Ave. Est. cost $15,299.

Mich., Oakwood—Village plans to spend $25,000 for extension of sewer system and $30,000 for extension of water system.

Minn., St. Cloud—Plans for sewer addn. to Pan Motor Co. being prepared by R. E. Borrowman, City Engr. Est. cost $250,000. Will ask Govt. for permission to construct. A. W. Buckman, City Clk.

Miss., Hattiesburg—City council considering issuing sewer and water extension bonds to amount of $25,000.

Miss., Pascagoula—The city will improve streets and the sewer system at approximate cost of $100,000. Xavier A. Kramer, Magnolia, Miss., consulting engr.

Mo., St. Joseph—City considers construction of sewer in Morris Ave. from Arthur's branch to Brown's branch, at estimated cost of $16,000. H. Johnson, city engineer.

Nebr., Humphrey—City is considering construction of $30,000 sewerage system. W. E. Standeven is city engineer.

N. J., Dover—City considering elec. to vote on $50,000 bonds for purpose of bldg. lateral sewers. G. E. Jenkins, City Engr.

N. J., Trenton—City considering improving Lipton, Clearfield, Bloomfield, Westminster, Newell, Leclade, Lee and Columbus Sts., by installing 6,150 ft. 8-in., and 946 ft. 10-in. pipe sewers. J. R. Fell, 134 N. Clinton Ave., Engr.

N. Y., Gloversville—Plans being drawn for sewer in Foster St., North End., 400 ft. 20-in., 2,660 ft. 12-in. pipe. E. J. Hammer, City Engr.

N. Y., Hempstead, L. I.—Government has taken over unused portion of Hempstead disposal plant and will use 25 acres to build modern disposal plant, in order to properly dispose of the sewerage of Camp Mills.

N. Y., Syracuse—Ord. adopted for immediate constr. of Seventeenth Ward sewer. Est. cost $35,000. Pumping station will be erected in Fellows Ave.—so. of Dakota St.

O., Akron—Ordinance passed to issue $12,000 bonds for pumping station for West Hill sewage disposal plant. H. N. Seiler, city clerk.

O., Canton—Ordinance passed to issue $10,000 in bonds to complete construction and installation of new sewage disposal plant. Henry A. Schrantz, pres't of council.

O., Lima—Fuller & McClintock, Engrs., New York City, have started work on plans for new sewerage system. It is planned to create a whole new sys. of sewers to run in conjunction with old sys. Main trunk lines and smaller auxiliary lines will be laid. Est. cost abt. one million dollars.

O., Springfield—Petition filed requesting City Comn. to construct san. sewer on Rubsain St.—Light to Rave St.; also on Race St.—Rubsain to Cedar. Est. cost $9,537.

O., Youngstown—Brier Hill Steel Co., through arrangement with Director Sause, will take over completion of Brier Hill district sewer—now constructed within 500 ft. of plant—and continue line to western limits of city. City will expend abt. $5,000; steel company will bear remaining expense—$15,000 to $20,000. Abt. 2,700 ft. sewer remains to be completed.

O., Youngstown—Ord. passed to issue bonds for constr. of sewers in portion of following streets: Arch, Albert, Craven, Harvard, Hartzell, Manhattan, Ohio, Wilcox & Butler Aves., Southern Blvd., and others.

Okla., Ardmore—City has voted $490,000 of sewer and water bonds.

Okla., Ardmore—Plans being prepared by Mackintosh-Walton Co., Engrs., 1022 State Natl. Bank Bldg., Okla., for extension to san. sewers and water supply. G. W. Croom.

Okla., Oklahoma City—Benham Engineering Co., Colcord Bldg., Oklahoma City, engaged by city to prepare plans for sewer construction. Available, $240,000 in bonds.

Okla., Okmulgee—Burns & McDonnell, Kansas City, consulting engrs., have completed plans for the extension to Okmulgee water works and sewer sys., and work will start in abt. 4 weeks. Est. cost, $535,000.

Okla., Ponca City—City plans to spend $35,000 for sewer construction. Burns & McDonnell, Interstate Bldg., Kansas City, Mo., consulting engrs.

Ore., Astoria—City will construct conc. main trunk sewer and drain to be known as Sewerage & Drainage System No. 5. E. G. Gearhart, Aud.

Ore., Pendleton—Acting mayor Vaughn states that sewage treatment plant will be constructed as soon as possible at an approximate cost of $25,000. City engineer, Geary Kimball, will prepare plans.

Pa., Albion—Plans prepared by C. C. Hill, Engr., 24 Main St., for sewage disp. plant and sewerage sys. Abt. $30,000.

Pa., Ashley—City contemplates constr. of sewer system. Abt. $50,000. Boyle & Howe, Bennett Bldg., Wilkes Barre, Engrs.

Pa., Erie—Chester & Fleming, Engrs., Pittsburgh, have been retained by city to prepare plans for sewage disposal and intercepting sewer system.

Pa., Johnstown—Ordinance pending in council providing for issuing $200,000 sewer, garbage disposal plant and street improvement bonds.

Pa., Scranton—Ord. passed by Council to build sewerage system in 21st Ward. Abt. $165,416.

Pa., Turtle Creek—Joseph Schmidt, boro secretary, will soon take bids on construction of 36 in. vitrified clay pipe sewer on Penna. Ave. Harrop & Hopkins, 801 Home Trust Bldg., Pittsburgh, consulting engrs.

Texas, Waco—The city is planning to spend $350,000 for sewer bonds to defray the cost of constructing a sewage disposal plant to handle the sewage of the city of Waco and Camp MacArthur.

Va., Seven Pines—War. Dept. will construct 7-mile sewer system for industrial city of bag-loading plant. $3,000,000 expenditure for sewers, water works, etc., etc. Gannett, Seelye & Fleming, Engrs., Harrisburg, Pa.

W. Va., Weston—Chas. E. Collins, Engr., Drexel Bldg., Phila., drawing plans for sewage disp. plant for State Hospital. Est. $45,000. J. B. Stephenson, Pres. State Bd. of Control, 403 Capitol St., Charleston, W. Va.

WATER SUPPLY AND PURIFICATION

Ala., Florence—$175,000 bonds voted by city for purpose of extending water works system and to enlarge filtr. plant. C. W. Negley, City Engr.

Ala., Montgomery—Plans being made for new main from city to connect at Base Hospital. At the Hosp. will be built a 200,000-gal. storage tank. Est. cost of tank $7,000. Work will start in abt. ten days on constr. of 10-in. main (wood stave pipe)—abt. 6 miles main constr. Est. cost abt. $90,000. This main is to reinforce present water main in use at camp.

Ark., Waldron—Plans and specifications are being prepared for a municipally owned water works system.

Cal., San Diego—Estimate filed by Engr. Geo. Cromwell, of cost of proposed retarding dam in Powder House canyon, to prevent overflow of diverting dam in Switzer Canyon. Est. cost $14,965. Plans call for earth dam 27 ft. high with conc. face; would impound 38,859,000 gals.

Ga., Atlanta—City has appropriated $101,850 for improvts. at coagulating basin and purification plant. Est. cost $155,000, of which amt. Fulton Co. is expected to appropriate $53,150. H. N. Hurt, Ch. of Constr.

Ill., Elmhurst—City planning to bld. distributing sys. and water mains. Abt. $300,000. E. Hancock, 2047 Odgen Ave., Chicago, Engr.

Ind., Anderson—Plans being completed for rebldg. Argos pumping station. Complete new electrical equip. and automatically controlled pressure sys. will be installed. H. J. Fauber, Designing Engr., So. Bend.

La., Arcadia—Water works improvements will be made at probable cost of $50,000. Bertram Barnette is mayor, and Xavier A. Kramer, Magnolia, Miss., is consulting engr.

La., Monroe—The city contemplates constructing a water filtration plant at estimated cost of $50,000.

Md., Baltimore—City has purchased site

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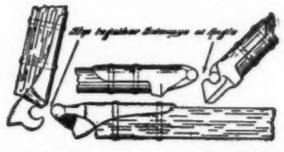
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for filtration plant addns. Will expend $1,000,000 for headhouse, 2 coagulent basins, filters, filter water reservoir and alum plant. Walter E. Lee, City Water Engr.

Mich., Cassopolis—City considering improving water works. Involves one 80,000 gal. steel tank; one 350-gal. motor-driven centrif. pump; one 750-gal. motor-driven centrif. pump & chlorinating apparatus. Holland, Ackerman & Holland, 122 4th Ave., Ann Arbor, Engrs.

Mich., Ferndale—Ferndale Commission has appointed Comm.to investigate possibility of extending Detroit 10-in. water main (now under constr. on Woodward Ave., betw. Seven and Eighth mile rds.) through this village. Bond issue $62,000 proposed for water and sewer improvements.

Mich., Wyandotte—The Wyandotte district, including Ford Village, is considering installation of water filtration plant at estimated cost of $200,000.

Miss., Greenwood—City will lay 2,000 ft. 6-in. c. u. pipe during the year. Roy Stott, Mgr. Light & Water Plant.

Minn., Crosby—Water mains will be extended at estimated cost of $50,000. John Wilson, Duluth, Minn., is consulting engr.

Mo., Richmond—W. Kiersted, Engr., Liberty, Mo., engaged by City to prepare plans for water works improvts. $32,000 bonds voted for this work.

Mont., Cascade—City contemplates improving water plant by sinking of wells and constructing pumping plant. Engrs. C. W. Swearingen and C. B. McCulloh, Great Falls.

N. H., Kittery—The town of Kittery, through its water district, has voted to rebuild its main pipe line for the use of the Navy Yard at a cost of $200,000. Work authorized by Public Utilities Commission of Maine. Work will be started at once. The work will include, beside the new main the raising of the dam of Folly Pond.

N. M., Santa Fe—Santa Fe Water & Light Co. contemplates extending water works sys. If city accepts proposition work will involve bldg. earth dam to cost abt. $200,000.

N. Y., Watervliet—Election resulted in favor of issuing $130,000 water system improvement bonds.

N. C., Wilmington—City plans addns. to water works; increase supply by 2,000,000 gals. daily; drill deep wells; install mchy. costing $35,000. J. H. Sweeney, Ch. Engr.

O., Bryan—$90,000 bond issue voted for water plant and light plant improvements. $40,000 was previously voted—total of $130,000 for new machinery and plant extensions.

O., Lima—Ord. passed to issue $150,000 bonds for purpose of increasing size of water wks. sys. by providing new storage at what is known as Lost Creek site, new pumps, necessary conduit lines, new boilers, filtr. plant and repair of Lima Lake.

O., Ravenna—City council has approved revised plans of B. F. Batchelder, director of Public Service, for new water filtration plant, which is urgently needed.

O., Toledo—Plans under way to run 12-in. water main from city system at Ironville to Air Nitrate Corp. cantonment, to be constructed near Craig Oil Refinery.

O., Wooster—Ords. passed authorizing Service Direct. to ask bids for construction of booster station on N. Buckeye St.; also authorizing him to contract for constr. of deep well in Killbuck Valley.

Okla., McAlester—Sept. 17 City Commrs. will place before people question of issuing $630,000 water wks. bonds. Water proposition, if approved by voters, will include condemnation & purch. of land for reservoir which would, after constr. of dam, impound abt. 3,500,000,000 gals. water from watershed of more than 32 sq. miles to proposed new pumping & filtr. plant.

Okla., Ponca City—$75,000 bonds voted by City for purpose of improving water works and light system.

Ore., Pendleton—Plans of Prof. Beckwith, state bacteriologist, that water taken from Umatilla river for Pendleton be treated chemically at gate house, will be carried out.

Pa., Elizabethtown—City will lay abt. 1,400 ft. wood pipe this year. P. Shirk, Supt. Water Wks.

Pa., Lansford—City contemplates installing 2,000 ft. 6-in. and 4,000 ft. 8-in. c. i. pipe. J. B. Waniner, Supt. Water Wks.

Pa., McKeesport—$75,000 to be expended to change source of water supply and add new chemical equipment.

R. I., Providence—Bd. Contr. & Supply soon to ask bids for bldg. dam across Moswansicut River at N. Scituate, to provide reserve of 30,000,000 gal., pending completion of main reservoir. Abt. $40,000.

S. C., Columbia—City considering installing electric pumps at water works. Fred C Wyse, Supt.

S. D., Pierre—$100,000 bond issue voted to replace water and electric light plant recently destroyed by fire.

Tex., Austin — $240,000 Stamford city water works bonds have been approved by Attorney-General.

Tex., Galveston—City considering installation of 600-ft. half-inch pipe per month; includes repairs; also 200 new service meters. A. T. Dickey, Water Wks.

Tex., Mt. Auburn—New water mains will be laid. Est. cost $12,000.

Va., Alexandria—The Alexandria Water Co. will receive bids in Sept. for construction of gravity filtration plant of daily capacity of 2,000,000 gals. D. J. Howell and Son, engineers, Union Trust Bldg., Washington, D. C.

Va., Richmond—$54,500 appropriated by City for improvements, piping, etc., to furnish water at Govt. boiler-plate plant, including $7,500 8-in. main.

Va., Seven Pine—War Dept. will construct water works for indust. city of bag-loading plant. $3,000,000 expendt. for water works, sewers, electric light system, etc., etc. Gannett, Seelye & Fleming, Engrs., Harrisburg, Pa.

Wash., Seattle—City contemplates laying water mains in E. Marginal Way and Michigan St. Est. cost $165,000. Specifications include 17,500 ft. 16-in. pipe, 700 ft. 12-in. pipe, 16 gates and 60 hydrants.

Wash., Spokane—Present wooden water mains on 14th Ave., between Monroe and Grand Blvd., will be replaced with cast iron pipe at estimated cost of $17,000. Water Superintendent Lindsay states work will start shortly.

Wis., Madison—The city will readvertise for bids for the construction of the Wingra Sewage Pumping Station at probable cost of approximately $15,000. O. S. Norsman, City Clerk.

Wyo., Rock Springs—City will lay 1,500 ft. 8-in. c. i. pipe; also 2 Venturi meters. D. V. Bell, 325 N. Front St., Rock Springs, Supt., Green River Water Wks. Co.

BRIDGES AND BUILDINGS

Ala., Montgomery—Construction of rein. conc. bridge across Catoma Crk. on Norman Bridge Rd., has been approved by Government. Est. cost $50,000; Fed. govt. and State will furnish abt. $20,000 of the cost.

Cal., Merced—Government will construct new bridge over Merced river at the Sentinel Hotel. Bridge will be rein. conc., probable double-arch design. Est. cost abt. $15,000.

Cal., Oakland—Bd. of Supvrs. has instructed Co. Engr. to prepare plans for repairing Estuary brdg. Approx. cost $40,000.

Cal., Croville—Plans ordered for const. of conc. bridge across Feather river near here. Est. cost $125,000. County will also build 10 other conc. bridges along line of lateral & main trunk hwy. Total cost of bridge work contemplated for present season is etsimated by Martin C. Polk, Co. Surv. at $142,220.

Cal., San Diego—State Hwy. Comn. will construct, in near future, 23-span 30-ft. high conc. trestle bridge over San Luis Rey river near Oceanside.

Cal, Vallejo—Government has authorized constr. of steel causeway linking this city with U. S. Navy Yard on Mare Island.

Fla., Jacksonville—On Sept. 3 Duval County will vote on issuing $225,000 bonds to construct a bridge across McGirts Creek on proposed road to Camp Joseph E. Johnston.

Ida., Caldwell—Canyon Co. will vote Sept. 3rd on $70,000 bridge bonds. L. C. Knowlton, Co. Clk.

Ill., Marion—Asst. State Engr. Scott estimates bridge over McKeown Hwy. will necessarily be 100-ft. span. Bridge will also be built on Wallace McCue hwy. Est. cost $7,000 to $8,000, and $6,000, respectively.

Ill., Springfield—Dept. Pub. Wks. & Bldgs., soon to award contr. for bldg. rein.-conc. brdg. 120 ft. long. Est. cost abt. $18,890. G. F. Burch, Acting Brdg. Engr.

Ind. Brazil—Bd. of Commrs. will soon ask bids for construction of various bridges, aggregating $20,000,

Md., River View—Specifications submitted to War Dept. by Anne Arundel Co. Commrs., Annapolis, for constr. of drawbridges across South River.

Mass., Barre—Town contemplates rebldg. bridge. S. H. Pitcher Co., 44 Front St., Worcester, Engrs. Abt. $15,000.

Mo., Allendale—A concrete and steel brdg. will be constructed across the Grand River west of here, in Worth County, at estimated cost of $6,000.

Mo., Columbia—County Court has agreed to co-operate with Calloway Co., & State Hwy. Comn., in erection of steel bridge over Cedar Crk. on Callaway Co. and Cedar Crk. gravel rd. Est. cost $7,000.

N. J., Trenton—State Bd. Commerce & Navigation has granted permission to Jersey Central R. R. to construct new bridge across Newark Bay—Elizabethport to Bayonne. Est. cost $7,000,000. Structure will have four tracks; it will be steel-conc. in its columns, with 125-ft. span betw. each column; 2,200-ft. draw spans.

N. C., Halifax—Halifax Co. Commrs. will construct $61,000 bridge across Roanoke River.

N. C., Scotland Neck—Halifax Co. Commrs., Halifax, N. C., considering erection of bridge across Roanoke River. Plan approved by State Hwy. Comn. Fed. fund to supply $15,000 of cost.

N. C., Williamston—Martin Co. Commrs. considering erection of brdg. across Roanoke River. Est. $100,000. State Hwy. Comn. approved constr. of fed. aid to amt. of $30,000.

O., Lima—Ord. passed to construct brdgs. over Ottawa river at its intersection with Collett St., West St. Pierce St., Main and Jackson St., and No St.; together with approaches, abutments and retaining walls. Bonds will be issued in sum of $50,000 for improvement.

O., Lima—Council has voted to proceed at once with erect. of viaduct over Lake Erie & Western Main line & yd. tracks on Wapakoneta Rd. Viaduct will be paid for by railroad, city and county.

O., Youngstown—F. M. Lillie, City Engr., preparing plans for new brdg., 3,000 ft. in length. This will eliminate grade crossings and provide new hwy. over Mahoning River on Division St.

Okla., Asher—Co. Commrs. have ordered $100,000 bonds to be voted on at elec. in August; proceeds to be used for constructing high water bridge across So. Canadian near here. Allan Gowan, Commr.

Pa., Harrisburg—City & State Bd. Pblic. Grounds & Bldg. considering construction of conc. viaduct, 2,000 ft. long, 80-ft. wide, over railroad yds. on State St.; viaduct to be arch design, 150 ft. wide, extending on continuous grade from State Capitol Park at 4th & State Sts. to 15th St. Est. cost $500,000. M. B. Cowden, City Engr.

Pa., Harrisburg—Tentative plans for proposed State St. viaduct, drawn by Arnold W. Brunner, Capitol Park Zone archt., met with approval of State officials and brdg. experts. City's share of cost is suggested to be the $300,000 that had been appropriated for Walnut St. bridge; other portion to be paid most likely by State & Penn. R. R.

Pa., Mayfield—Bridge Comn. of Mayfield Council considering constr. of a rein. conc. bridge to cost approx. $10,000.

Utah, Salt Lake—Site for proposed interstate brdg. over Henrys Fork has been selected by Wyoming and Utah officials. East state will pay ¼ of cost and each interested county similar amount. Est. cost abt. $3,600.

Va., Stafford—$10,000 will be expended by Spottsylvania Co. Commrs., for rebldg. bridge.

Wis., Madison—After plans for new conc. brdg. over Starkweather Crk. on Milwaukee St. are approved by State Hwy. Comn. they will be recommended to City Council. Est. cost $3,700. City will pay three-fourths; the town of Blooming Grove, the balance.

Wis., Sheboygan—Engrs., Klug & Smith, Mack Bldg., Milwaukee, completing plans for steel bridge, 220 ft. long, 60-ft. basc. span, 24 ft. rdway. 2 7-ft. walks, conc. abuts., prob. monolithic brk. pavement. C. U. Boley, Engr.

Wis., Wausau—Plans under way for constr. of conc. and steel brdg., 7 30-ft. spans. Est. cost $12,500. Plans with Marathon Co. Hwy. Comsn.

Wis., W. Allis—City will construct two conc. bridges over Honey Creek as soon as plans are completed.

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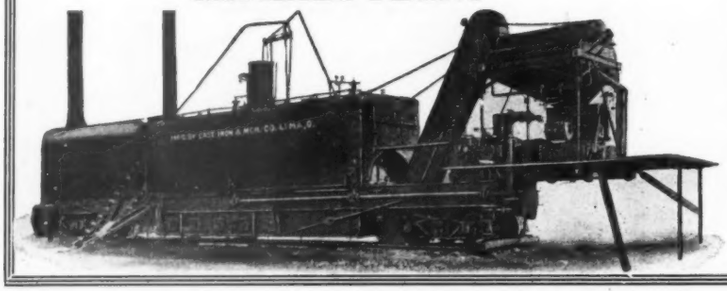

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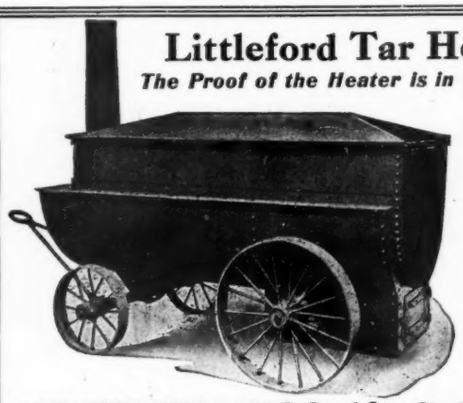

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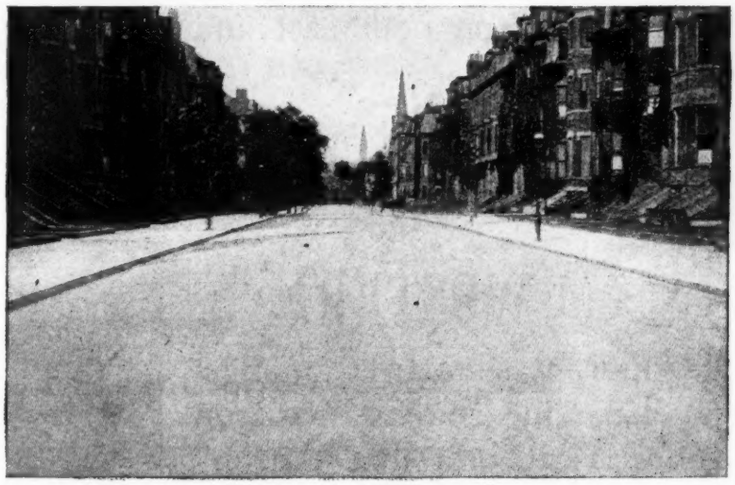

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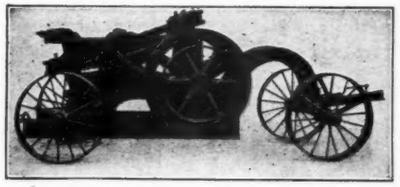

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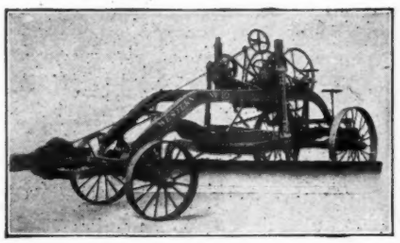

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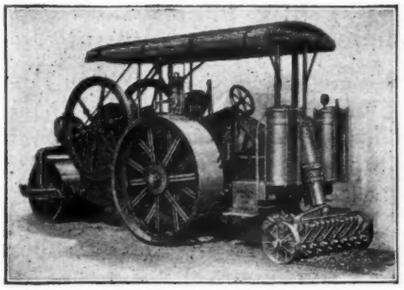
Street Sweepers
Combined Sprinkler-Sweepers
Dump Wagons
Stone Spreaders
Horse-Drawn Rollers

Catalogue No. 18 describes all of the above.



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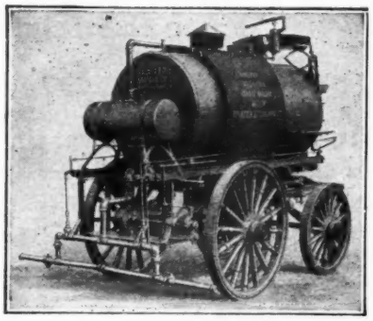

Austin Oiler

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